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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) 554

89 ASTRONOMY 554
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 555
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 555
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 556
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 557
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL N.A.

Note: N.A. means that no abstracts were assigned to this category for this issue.

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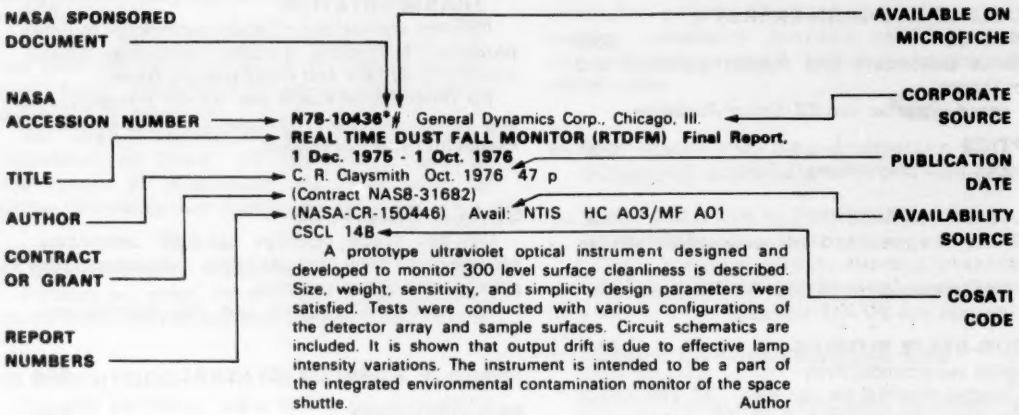
CORPORATE SOURCE INDEX I-55
CONTRACT NUMBER INDEX I-69
REPORT/ACCESSION NUMBER INDEX I-73

TYPICAL CITATION AND ABSTRACT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N78-10436*# General Dynamics Corp., Chicago, Ill.
REAL TIME DUST FALL MONITOR (RTDFM) Final Report, 1 Dec. 1975 - 1 Oct. 1976
C. R. Claysmith Oct. 1976 47 p
(Contract NAS8-31682)
(NASA-CR-150446) Avail: NTIS HC A03/MF A01
CSCL 14B
A prototype ultraviolet optical instrument designed and developed to monitor 300 level surface cleanliness is described. Size, weight, sensitivity, and simplicity design parameters were satisfied. Tests were conducted with various configurations of the detector array and sample surfaces. Circuit schematics are included. It is shown that output drift is due to effective lamp intensity variations. The instrument is intended to be a part of the integrated environmental contamination monitor of the space shuttle. Author

ON-GOING RESEARCH PROJECTS

This is a listing of research projects – not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, AERONAUTICAL TECHNOLOGY, TECHNICAL AREA K - FLIGHT SIMULATION
I.C. STATLER, U.S. Army, Air Mobility Res. & Dev. Lab., *Moffett Field, California* 94035 (DA0D5000)

Perform analyses and design studies of the requirements of a rotary-wing R&D flight simulator capable of simulating NOE flight operations. Available simulation technology allows a total integrated systems approach to R&D involving conceptual designs, preliminary and detail design trade-offs, man-machine interactions, mission capabilities, support of flight tests, and product improvement evaluation.

In joint participation with NASA, perform the studies with the expectation of modifying an available NASA simulator to meet the Army's mission requirements.

ADDENDA: Supporting agency address is: AVRADCOM Air Mobility R&D Lab, Ames Dir, Ames Rsch Ctr, Moffett Field CA 94035

SUPPORTED BY U.S. Dept. of Defense, Army

1.0002, EXPERIMENTAL STUDIES RELATING TO AIRFOIL UNSTEADY AERODYNAMICS
K. KARAMCHETI, Stanford University, School of Engineering, *Palo Alto, California* 94305 (NSG 2233)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0003, STANFORD/AMES JOINT INSTITUTE FOR AERONAUTICS AND ACOUSTICS, HELICOPTER NOISE DETECTION STUDY
K. KARAMCHETI, Stanford University, School of Engineering, *Palo Alto, California* 94305 (NSG 2254)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0004, ANALYTICAL INVESTIGATION OF THE FLOW FIELD AROUND A ROTOR BLADE
K. KARAMCHETI, Stanford University, School of Engineering, *Palo Alto, California* 94305 (NSG 2255)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0005, NUMERICAL STUDY OF THE FLOW IN A SIMULATED WING-FUSELAGE JUNCTURE
W.R. BRILEY, Scientific Res. Assoc. Inc., *Glastonbury, Connecticut* 06033 (DN775273; N00014-77-C-0075)

The development of accurate numerical methods to describe the flow about aircraft and missiles is essential for their design and optimization. This research will study, within the framework of the incompressible Navier-Stokes equations, the structure of the flow field in the vicinity of the intersection of a wall (with its accompanying boundary layer) and a wind rounded leading edge.

The flow in the vicinity of an airplane wing-fuselage juncture is extremely complex because, in addition to being three dimensional, it usually involves both separation and the formation of vortices. These vortices can have a pronounced effect on the wing characteristics. Because of the complicated nature of the flow, analysis is of limited value and experiments would be both time-consuming and costly. The present investigation isolates the juncture region as an element of the entire flow field. Within this element the flow will be studied by an alternating direction implicit method within the framework of the Navier-Stokes equations--the only reliable description of the flow.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense, Navy

1.0006, AIRSPACE MANAGEMENT
D.R. SHIER, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234 (2050491 (NBS NO.))

PURPOSE: To aid the FAA in establishing separation standards which both facilitate efficient use of airspace (as well as other resources), and ensure safe operation of aircraft.

OBJECTIVES: Plan for the collection and analysis of data concerning current height-keeping performance. Refine procedures for evaluating performance. Analyze requirements for maintaining and improving performance, and investigate problems associated with standardization of height-keeping measures.

FY-77 MILESTONES: (1) Design analysis procedure to be used for estimating vertical position errors from suitable data; help FAA design data-collection effort, (10/77). (2) Refine procedures for evaluating height-keeping performance, (10/77). (3) Investigate problems associated with worldwide standardization of the units for height-measurement, (10/77). (4) Investigate technical requirements for certification and maintenance of measurement and height-keeping equipment, (10/77).

ACCOMPLISHMENTS: Investigated analytical models for evaluating height-keeping performance based on principal measurements, equipment, information flow and control logic. Classified sources of errors; estimated their magnitudes to the extent current data allow. Described requirements for additional data to estimate critical error components. Documented progress in NBSIR76-1067.

BIBLIOGRAPHIC REFERENCE: NBSIR 76-1067, Mathematical Approaches to Evaluating Aircraft Vertical Separation Standards, by Judith F. Gilsinn and Douglas R. Shier, issued May 1976.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin., Aircraft Development Service

1.0007, STRUCTURAL DYNAMICS LABORATORY
M. LEE, General American Trans. Corp., *Chicago, Illinois* 60648 (DF641550; F08635-77-C-0103)

Air Force function - this work unit is established to define aircraft and store structural dynamic characteristics. Deficiency or opportunity - currently there exists no way for the actual modal dynamic characteristics to be defined. Objective - to design and install soft suspension equipment which will be used to define aircraft and store dynamic modal characteristics for flutter solutions. How work contributes - this work will allow for the prediction of catastrophic failure of the aircraft and store during flight.

Design and install a soft suspension equipment and perform dynamic modal analyses and use to predict flutter of aircraft and store combinations.

ADDENDA: Supporting agency address is: AF Armament Laboratory DLJC Eglin AFB, FLA 32542

SUPPORTED BY U.S. Dept. of Defense, Air Force

1.0008, LOW-SPEED, HIGH-LIFT AERODYNAMICS
W.D. JAMES, Iowa State Univ. of Sc. & Tech, School of Engineering, *Ames, Iowa* 50011 (NSG 2257)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0009, FORECAST INFLATIONARY IMPACT OF LATEST PROPOSED RETROFIT/NOISE ABATEMENT POLICY ISSUE
UNKNOWN, Jack Faucett Associates Inc., *Chevy Chase, Maryland* 20015 (OS-60085/3; OS59964 (TRAIS NO.))

The objective is to forecast and report the inflationary impact of the latest proposed RETROFIT/Noise Abatement Policy Issue concerning the U.S. airline fleet which has been under discussion between the Department of Transportation, OMB, and the White House.

SUPPORTED BY U.S. Dept. of Transportation, Office of the Secretary

1.0010, OH-58A ARMS DATA PACKAGE - MOD AH-1G ARMS INPUT TO AN AH-1S DATA PACKAGE
J.E. MARSH, Cobro Corporation, *Silver Spring, Maryland* 20901 (DA0D4102; DAAJ02-77-C-0017)

The objective is to acquire representations of the OH-58 and the AH-1S helicopters for use by the US Army in the Army Reliability and Maintainability Simulation (ARMS) model. This will give the Army the capability of computer-aided studies using these aircraft.

The OH-58 and AH-1S will be defined for use in the Army Reliability and Maintainability Simulation (ARMS) model. The helicopters will be defined in terms of reliability and maintainability, mission scenarios, GSE, and manpower levels. The aircraft will be sufficiently defined to be useful in any Army study on these aircraft. The models will be validated to assure credible results then made available for Army use.

ADDENDA: Supporting agency address is: AVSCOM Air Mobility R&D Lab, Eustis Dir, Ft Eustis VA 23604

SUPPORTED BY U.S. Dept. of Defense, Army

1.0011, CONCORDE AIR POLLUTION MONITORING
UNKNOWN, Environmental Res. & Tec. Inc., *Concord, Massachusetts* 01742 (FA59188; FA76WA-3817)

The purpose of this effort is to conduct an Installed Measurement Program to determine: (1) possible air quality change at the measurement sites during Concorde operations; (2) if pollutant concentration changes occur during specific Concorde events; (3) to provide actual on-site measurements of airport and neighborhood meteorological conditions; and (4) to provide ambient air quality data in the vicinity of Dulles International Airport during the presence of the Concorde and during normal airport operations.

SUPPORTED BY U.S. Dept. of Transportation, Office of the Secretary

1.0012, INCORPORATION OF ASOP-3 INTO FASTOP
J. MARKOWITZ, Grumman Corporation, *Bethpage, New York* 11714 (DF140480; F33615-77-C-3027)

High-performance requirements on modern aircraft make it essential that airframe designs be as light as possible and yet stiff and strong enough to avoid failure. To support the mission of providing accurate design information on complex airframes, computer codes must be developed which efficiently determine minimum-weight design data on critical structural components. The increasing use of lightweight composite materials provides great stiffness and strength, but their complex elastic properties cannot yet be adequately handled by the design program. The objective of this present effort is to upgrade the capability of the Air Force's primary stiffness and strength design program, FASTOP, by inclusion of a new composite strength code, ASOP-3. When these programs are fully integrated, aircraft lifting surfaces of composite constructions can be designed to meet strength and stiffness at minimum weight.

The SOP coding of FASTOP will be replaced with the new ASOP-3 code. Appropriate considerations will be given to data managment to insure full compatibility with the flutter optimization portion of the program. Logic for rounding results to an integer number of layers and revised output reflecting the addition of composite material will be included. Two composite lifting surfaces will be studied and the results documented.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FBR, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

1.0013, NAVIGATION FLIGHT TEST SYSTEM (NFTS) AND SUPPORT
UNKNOWN, Grumman Corporation, *Bethpage, New York* 11714 (FA58538; FA75WA-3613)

TASKS INCLUDE: 1) Prepare the requirements analysis, specification, cost analysis, and implementation plan for the airborne data acquisition system. 2) Procure and install the NFTS in a Government-furnished DC-6 aircraft at NAFEC, including the procurement of one production model each and evaluate the airborne VOR and DME equipments designated by the Government. 3) Validation of the test bed. 4) Prepare the requirements analysis, specification, cost analysis and implementation plan for an expanded airborne data acquisition system.

SUPPORTED BY U.S. Dept. of Transportation, Office of the Secretary

1.0014, STUDY OF THE IMPACTS OF AIRPORT USE RESTRICTIONS ON AIR FREIGHT CONSUMERS AND PASSENGERS
G. HOWARD, Port Auth. of New York & N.J., *New York, New York* 17357 (FATQWA-3875; FA59695 (TRAIS NO.))

A survey of nighttime air freight shippers and receivers shall be made to estimate the effects of local and national airport nighttime airport use restrictions on both shippers and receivers moving air freight via the Port Authority airports and their relationship. The contractor shall quantify the economic consequences to air freight consumers of both local and national airport nighttime airport use restrictions on the basis of the waybill survey of nighttime air freight shippers and receivers. The objective is to make possible projections of national impacts of nighttime airport use restrictions.

SUPPORTED BY U.S. Dept. of Transportation, Office of the Secretary

1.0015, PROGRAMMING SERVICES IN SUPPORT OF THE CONTROLLER/COMPUTER INTERFACE LABORATORY MISSION
UNKNOWN, U.S. Small Business Admin., *New York, New York* 10007 (FA77NA-4004; FA59983 (TRAIS NO.))

The purpose is to provide technical assistance and support to the Human Engineering Branch at NAFEC in development of software for the Controller/Computer Interface Laboratory (CCIL). The CCIL is a NAFEC Facility used by Human Engineering personnel engaged in making evaluations of candidate air traffic control data entry and display configurations.

SUPPORTED BY U.S. Dept. of Transportation, Office of the Secretary

1.0016, ENGINEERING PROPERTIES OF AIRFIELD BASE AND STABILIZED BASE MATERIALS
W.H. HIGHTER, Clarkson College of Technology, School of Engineering, *Potsdam, New York* 13676 (DF049150; AF-AFOSR-3364-77)

AF function - construction of more durable airfield runway pavement bases. Deficiency/opportunity - Air Force airfields are called upon to handle heavy aircraft routinely and to maintain readiness for emergencies. Runways that are damaged unexpectedly cause interruptions in operations and leave potential gaps in military readiness. This research will contribute toward better nondestructive evaluation of runways, permitting scheduling of needed maintenance and planning of alternate readiness arrangements. Objective - to obtain predictions of Young's modulus for pavement base materials. How work contributes - the Air Force Civil Engineering Center uses a finite-element computational system as part of a nondestructive evaluation for runways used for aircraft operations. The constitutive equations used for the pavement base materials are nonlinear, and they require the use of Young's modulus as a function of the state of stress of the material. This research will provide a different method of predicting Young's modulus, and thus provide an independent check on the methods already in use.

Existing data on Young's modulus and soil stress under pavements subjected to aircraft landing and take off rolls will be collected, systematized, and correlated to obtain a theoretical prediction method for the stress-strain relationships.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

1.0017, COMPRESSIBLE AIRFOIL DESIGN METHODOLOGY
G.M. GREGOREK, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (DF140070; AF-AFOSR-3273-77)

This work unit supports the development of advanced USAF high-altitude long-endurance aircraft. Presently, high-altitude long-endurance aircraft used for military missions are limited in altitude and payload capability. Advanced technology airfoils will help alleviate these lifting surface associated problems. This work effort is the development of a compressible subcritical airfoil design method which will be used to configure airfoils for future USAF aircraft. Use of these new technology airfoils will permit flight envelop expansion on future military high-altitude long-endurance air vehicles.

An existing incompressible inverse airfoil design procedure will be coupled with compressibility corrections to produce an accurate subcritical airfoil design method. Serveral airfoils applicable to high-altitude long-endurance aircraft will be developed using this method. The developed airfoils will be checked with proven analysis procedures to verify the new airfoil designs.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FXM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

1.0018, ADVANCED CARBON BRAKES FOR FIGHTER AIRCRAFT
P. SKELE, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF140890)

This effort supports the development of design and performance criteria, and test techniques required for the optimum use of advanced carbon brakes on Air Force aircraft. Air Force aircraft incur high operational costs and down times due to maintenance and replacement costs of aircraft brakes. The objective of this program is to evaluate the potential of carbon-carbon composite materials used in aircraft brakes, and to develop standards and specifications for carbon brakes for future USAF aircraft. Potential advantages are lighter weight resulting in increased payload or lower fuel costs, better friction characteristics resulting in more efficient gear structure, and longer wear life resulting in lower acquisition and maintenance costs per landing and less down time.

A series of dynamometer tests will be conducted on three brake sizes (13 inch rim 2 rotor, 16 inch rim 4 rotor, and 18 inch rim 3 rotor) to evaluate the performance characteristics of carbon materials in aircraft brakes. A total of 8 carbon brakes with construction and material variations will be tested, along with two beryllium and one steel brake in order that the carbon performance may be assessed by comparison with more conventional materials. Brake performance will be evaluated as a function of energy level, rate of energy input, brake temperature, and brake wear rate. Additional sizes and carbon material variations shall be included in the test program as they are developed and become candidates for current and future aircraft.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FEM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

1.0019, WING SLAT DEVELOPMENT PROGRAM
K.H. BERGEY, Univ. of Oklahoma, School of Aer. & Mech. Engin., *Norman, Oklahoma* 73069 (NAS 1-14986)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0020, LV STORE INVESTIGATION
F.L. HELTSLEY, Arnold Research Org. Inc., *Tullahoma, Tennessee* 37389 (DF421023; F40600-75-C-0001)

Using a laser velocimeter, a wind tunnel test will be conducted to measure the flow field velocities surrounding a store model in a transonic flow field. Measurements will be completed first for the store model in an interference-free environment and then for the store model in the presence of flow interference from a wing or from additional stores.

The flow field velocities measurements will be used to validate a theoretical prediction scheme for predicting velocities in the region surrounding aircraft external store configurations.

ADDENDA: Supporting agency address is: Arnold Engineering Development Center, Arnold AFS, TN 37389

SUPPORTED BY U.S. Dept. of Defense, Air Force

1.0021, SHUTTLE IMAGING RADAR - FLIGHT SYSTEMS/ANTENNA TRADE-OFF AND EVALUATION STUDY
G.L. CROW, Univ. of Texas, Applied Research Laboratories, *Austin, Texas* 78712 (NAS 9-15401)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

1.0022, RPV PROPELLER NOISE REDUCTION STUDY
R.P. WHITE, Systems Research Labs. Inc., *Newport News, Virginia* 23602 (DA0D4109; DAAJ02-77-C-0029)

The technical objective is to evaluate and establish low noise features for design of small-size low acoustically detectable propellers applicable to conceptual remotely piloted vehicle (RPV) aircraft.

This investigation will review past and present efforts covering the acoustic aspects of small-scale propellers. Ten propellers and two shrouds will be designed fabricated to accommodate a 220 lb. RPV aircraft. Aural detectability shall be the design driver in selecting various plane forms, shapes and blade numbers. The propellers and shrouds will undergo both static and dynamic tests in both tractor and pusher configurations. Performance and aural detectability will be closely investigated to provide guidance and trade-off data for design of low-noise RPV propellers.

ADDENDA: Supporting agency address is: AVCSOM Air Mobility R&D Laboratory, Eustis Directorate, Ft Eustis, VA 23604

SUPPORTED BY U.S. Dept. of Defense, Army

1.0023, ADVANCED FIBER-REINFORCED THERMOPLASTICS (AFRTP) FOR AIRCRAFT STRUCTURES
J.T. HOGGATT, Boeing Company, *Seattle, Washington* 98108 (DF136020; F336156*JCJ3048*)

Although significant advancements have been made in reducing the weight of aircraft structures through the use of advanced composites, further reductions in ownership and especially acquisition costs are potentially available through the substitution of thermoplastic matrix materials for the present thermosetting matrix materials (such as epoxies). Flat thermoplastic laminates can potentially be laid up and consolidated with highly automated processes, they can be stored without refrigeration as long as necessary (as can the thermoplastic adhesives) and they can then be postformed into complex shapes by applying heat and pressure. In addition, the thermoplastics can be welded in seconds either ultransonically or with an electromagnetic vibration welding technique. The objectives of the program are (1) to demonstrate the potential of advanced fiber-reinforced thermoplastics (AFRTP) to reduce the fabrication and assembly costs of aircraft structures, (2) to demonstrate the structural integrity and durability of an AFRTP component and (3) to simplify the repair procedures and reduce the cost of maintaining advanced composite structures.

The approach to attaining the objective is to select a structural component from either an operational system or a future production system, redesign the component, develop the manufacturing and repair techniques, manufacture the component and thoroughly test it. The selection of the demonstration article is restricted to a component that has a definite potential for acquisition cost savings and/or reduction in maintenance costs on an operational or future production aircraft. This program is sponsored jointly by the Manufacturing Technology Division of the AFML and the Structures Division of the AFFDL.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FBSB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, MULTICOMPONENT OXIDE SYSTEMS FOR CORROSION PROTECTION
W.H. STEIER, Univ. of Southern California, School of Engineering, *Los Angeles, California* 90007 (DF048800; AF-AFOSR-3334-77)

AF function - Air Force systems, particularly aircraft, are subjected to a variety of corrosive environmental conditions during their operating lifetimes. To increase reliability and reduce operating costs, improved protective coatings must be developed to minimize corrosion damage. Deficiency - corrosion damage to high-dollar-value equipment costs the Air Force an estimated 250 million dollars per year. Objective - to use a unique approach to the problem of corrosion protection for aircraft aluminum surfaces and to develop and characterize new multicomponent oxide coatings using criteria based on a conceptual model. How work contributes - substantial cost savings to the Air Force will result from improved anticorrosion coatings.

Evaluate the corrosion properties of aluminum oxide/chromium oxide, develop techniques for deposition of multicomponent oxide films, characterize these films by Auger and XPS analysis and evaluate their corrosion resistance.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NC, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

3.0002, CHEMICAL PHYSICS OF CHARGE MECHANISMS IN NONMETALLIC SPACECRAFT MATERIALS
J.E. NANEVICZ, Stanford Research Institute, *Menlo Park, California* 94025 (DF048670; F49620-77-C-0113)

AF function - operational and future Air Force space systems are required to perform their missions in extreme service environments. Deficiency - the interaction of a synchronous-orbit satellite with its environment activates electrification and electrical discharge processes producing electromagnetic noise pulses and effluents which deteriorate satellite materials, surfaces and components. Objective - the objective is to perform research to understand the mechanisms underlying spacecraft charging in polymeric and other nonmetallic dielectrics. How work contributes - it is expected that this research will contribute to the establishment of guidelines for the design and modification of satellite materials which are not degraded by the effects of electrical charging and which will minimize disruptions in Air Force space systems mission performance.

(a) Study nature, causes and effects of charging and discharging processes in typical spacecraft polymers and other non-metallic dielectrics under orbital conditions, (b) deter physics of critical electrostatic charging phenomena and properties of materials that affect electrostatic charging properties, and (c) study methods for modification of materials properties to improve their in-space performance characteristics.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

3.0003, STRUCTURAL CHARACTERIZATION OF PLASMA POLYMERIZED PERFLUOROBUTENE-2
J.V. ACRIVOS, Calif. State Univ. & Colleges, School of Natural Sci. & Math., *San Jose, California* 95192 (NSG 2247)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0004, DENSE SILICON-NITRIDE BODIES WITHOUT ADDITIVES
H.C. YEH, Cleveland State University, School of Engineering, *Cleveland, Ohio* 44115 (NSG 3155)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, RESEARCH STUDY - DATA MANAGEMENT SYMPOSIUM
E.A. CARTER, Univ. of Alabama, Graduate School, *Huntsville, Alabama* 35807 (NAS 8-32608)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0002, COMMUNICATION FADING AT MAGNETIC EQUATOR
J. WILSON, Fed. Univ. of Rio Gr. Do Norte, *Natal, Rio Grande Do Norte, Brazil* (DF249300; AF-AFOSR-3264-77)

AF function - communications. Deficiency - communications outages, radar errors and false targets. Objective - to provide observational data of ionospheric deep fading parameters at magnetic equator. How research contributes - results used in statistical models of fading depth and occurrence. This work continues observations of transmitting satellites from a station on the magnetic equator. The fading depths and rate are measured and statistical distributions are computed. The 30 foot steerable antenna is now operational. This location provides a point of observation almost midway in longitude between Huancayo, Peru, and Accra, Ghana, where similar studies show highly different behavior. The results are disseminated to communications designers and planners.

The approach is to record, reduce and analyze uhf radio signals from transmitting satellites in order to determine disruption caused by the equatorial ionosphere. Data reduction is accomplished by the grantee and the data are sent to AFCRL on punched cards and paper charts.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0003, STUDY TURBULENCE STRUCTURE

A. DEMETRIADES, Ford Motor Company, *Newport Beach, California* 92663 (DF139560; F33615-77-C-3016)

The function of this program is to acquire detailed measurements of turbulent fluctuation properties and Reynolds stress under adverse pressure gradient. This effort is designed to improve the computational accuracy for turbulent flows on aerospace vehicles. Many of the Air Force current aerodynamic problems can be traced back to a lack of understanding of the fundamentals of turbulence. The technical objective is to systematically investigate the turbulence structure under adverse pressure gradients and to obtain the variation of Reynolds stress distribution under these conditions. The programs' payoff to the Air Force will be the ability to predict turbulent boundary layer phenomenon on supersonic aircraft.

The turbulent fluctuations will be measured experimentally by means of a hot wire anemometer and a laser Doppler velocimeter on a boundary layer over a curved ramp. Correlation of these measurements will be carried out to obtain Reynolds stresses. The final product shall be the variation of Reynolds stress distribution with pressure gradient.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FXME, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0004, AN INVESTIGATION OF THE RELIABILITY EVALUATION OF COMPUTER SYSTEMS

E.J. MCCLUSKEY, Stanford University, School of Engineering, *Palo Alto, California* 94305 (DF047640; AF-AFOSR-3325-77)

AF function - the design of digital avionics systems. Important functions in growing numbers are being performed by digital systems on USAF aircraft. The consequent demands for reliable computing require newer and better designs in electronic circuitry. Deficiency - the correct functioning of the computer system is crucial since malfunctions could have catastrophic consequences for an aircraft. Such ultra-reliable computers are not yet available. Objective - to develop general tools and unified principles and methods for evaluating the reliability of competing possibilities in the design of computer circuits so that the best system configuration can be chosen for the required application. How work contributes - the results of this research, if successful, would permit the construction of ultra-reliable computers which are essential for advanced technology aerospace vehicles.

The research will be performed in three concurrent efforts, viz., analytic modeling (applying mathematical probability theory), simulation, and experimentation with actual prototype fault-tolerant computers such as the NASA dual computer system.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NM, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0005, DYNAMICS OF VORTICES AND SHOCK WAVES IN NONUNIFORM MEDIA

B. STURTEVANT, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (DF048980; F49620-77-C-0107)

AF function - advanced weapons systems. Opportunity -understanding the behavior of vortex rings and propagation of weak shock waves through nonhomogeneous mediums. The large-scale structure of turbulent flows are regions where the vorticity is concentrated and fluid motion is highly organized and coherent. The vortex ring is the simplest example of this type of motion. Understanding of the behavior of the vortex ring will provide valuable insight into the behavior of any turbulent boundary layer. In the analysis of the scattering of a weak shock wave in a fluid the equations are reduced to those identical to the mean motions of turbulence. Thus the study of the scattering of a weak shock wave may provide insight into the nature of turbulence. Objective - to study experimentally the nature and behavior of ring vortices and weak shock waves scattered by a nonhomogeneous medium. How work contributes -understanding of the dynamics of ring vortices and the propagation of nonlinear disturbances through a random atmosphere is essential to the understanding of turbulent boundary layers. This understanding has application in efficient air frame and wing design, the ability to produce more efficient combustion systems for advance power plants and gas dynamic lasers, the understanding of blast waves and sonic booms, in short, almost every fluid flow problem of interest to the Air Force.

A sharp, strong vortex ring will be produced by a shock tube. The characteristics and behavior of the vortex including the onset and type of instabilities will be studied using schlieren and shadowgraph photography. A spark will be used to mark a portion of the fluid to evaluate velocity components and circulation of the vortices. Different turbulence conditions will be generated in a shock tube and the characteristics of a weak shock propagating through the medium will be studied using shadowgraph and pressure transducers. A detailed comparison between the experimental observation and theoretical predictions will be made.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0006, FABRICATION OF SCALED SRM MODELS

W.A. STEPHEN, United Technologies Corp., *Sunnyvale, California* 94088 (DF189240; F29601-77-C-0041)

The objective is to produce a series of ten scaled solid rocket motor (SRM) models to be used in a test program which analyzes structural response of SRMs to earth impact in a launch abort situation. The data obtained from these tests will provide information for engineering studies related to nuclear safety evaluations of current and future DoD orbital/deep space missions.

The motors will be linearly scaled models of the 624a segments, five of which comprise the UA-1205 SRM, the strap-on launch booster for the TITAN III-C. The models will consist of motor casings, liner, and an inert propellant simulant whose mechanical properties duplicate those of the actual UTP-3001 propellant.

ADDENDA: Supporting agency address is: AF Weapons Laboratory NSQ Kirtland AFB, N Mex 87117

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0007, AUTOMATIC CORRELATION MEASUREMENT EXPERIMENT

F. ROTZ, Harris Corporation, *Melbourne, Florida* (DF712010; F30602-76-C-0381)

The objective of this effort is to provide an automatic experimental output measurement breadboard device to read-out parallax data in near real-time and to investigate CID, CCD, or TV raster scanner technique for improving the resolution, accuracy, and speed requirements necessary for the near real-time read-out of correlation peak locations in the output plane of the optical system.

Various tasks will be undertaken to provide for the automatic experimental correlation measurement breadboard device: 1. Evaluation sensors, such as CID, CCD and TV compatible scanners to determine the best methodology to increase the position detector about the correlation peak. 2. Evaluate the accuracy of the amplitude information obtained to determine the parameters for the design of the experimental position detector. 3. Include necessary instrumentation to allow for automatic collection of correlation data from real stereo models and evaluate the system performance of the automatic experimental correlation measurement breadboard device.

ADDENDA: Supporting agency address is: Rome Air Development Center IRR, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0008, DEVELOPMENT OF AN ADVANCED AVIONICS SYSTEM FOR GENERAL AVIATION
T.M. MCCALLA, Southern Illinois University, School of Engin. & Technology, *Carbondale, Illinois* 62901 (NSG 2238)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0009, LUMINESCENCE AND LASER STUDIES ON III-V SEMICONDUCTORS
N. HOLONYAK, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (DMR76-81432)

This project will involve luminescence and laser studies in III-V semiconductors. The principal materials will be indium (In)-gallium (Ga)-phosphorous (P)-arsenic (As) alloys grown by the liquid-phase-epitaxy technique. The studies will be in two parts: (1) Examination of nitrogen impurity trapping in the quaternary alloy In1-yGayP1-zAsz, the knowledge of which is important for efficient light emission, and (2) the construction and study of double heterojunction laser diodes which show the transition from inhomogeneous to homogeneous line broadening as current is increased. Here the heterojunction materials are In1-xGaxP1-zAsz on a GaAs1-yPy substrate. A major goal will be to prepare improved visible spectrum, large heterobarrier single and double heterojunction light-emitting diodes and lasers.

This is a renewal of NSF Grant DMR72-03045.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

4.0010, STUDIES OF SOME BASIC PROBLEMS RELATED TO SATELLITE ANTENNA SYSTEMS
S.W. LEE, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (DF049270; AF-AFOSR-3375-77)

AF function - a major component of a communications satellite is its antenna. It has to meet stringent specifications in its beam position, gain, sidelobes, polarization and bandwidth. Deficiency - the two most commonly used satellite antennas are the reflector antenna and the waveguide lens antenna. An incomplete procedure for their design prevents an accurate theoretical prediction of the antenna performance necessary for an optimal design. Objective - to eliminate some of the missing links in the design theory of satellite antennas. How work contributes - provide new methods applicable to design by solving related yet unsolved theoretical problems in electromagnetic theory.

1. Investigate the mutual coupling effects in a lens antenna, utilizing generalizations of infinite planar array diffraction and reflection analyses. 2. Explore novel and numerically efficient methods for calculating the secondary patterns of reflector and subreflector antennas.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0011, POWER SUPPLY INVESTIGATIONS
J.H. JENTZ, U.S. Navy, Avionics Facility, *Indianapolis, Indiana* 46218 (DN797008)

The objectives of this program are to improve the Navy's power supply technology base of universal input, off-line switching regulators; establish existing NASA computer analysis techniques at NAFI for fast, economical switching regulator analysis; and perform switching regulator component evaluations. All of the above will directly aid the development of the standard electronic module (SEM) and the standard avionics module (SAM) power supply families.

Areas of investigation will include: (1) off-line universal input switching regulator techniques will be reviewed, trade-offs performed, and breadboards of the best approaches will be built and evaluated for performance, size, weight, complexity, cost, etc; (2) component evaluations on the latest high-voltage semiconductors, high-current Schottky rectifiers, 4-terminal high-performance capacitors, EMI filters, hybrid and monolithic switching regulator control circuits. Control circuit manufacturers will be contacted and provided with suggested areas of improvement when considered worthwhile. Computer modeling and analysis programs for switching power supplies have been under development by TRW for NASA during the past few years. The usefulness and applicability of programs will be evaluated for NAFI use as they evolve.

ADDENDA: Supporting agency address is: Naval Air Systems Command 52022B1, Washington, D. C. 20361

SUPPORTED BY U.S. Dept. of Defense, Navy

4.0012, MONOLITHIC ZINC OXIDE SAW STRUCTURES
R.L. GUNSHOR, Purdue University, School of Engineering, *Lafayette, Indiana* 47907 (DF048470; AF-AFOSR-3304-77)

AF function - microwave signal processing devices are essential components of Air Force communications, reconnaissance, and electronic countermeasures systems. Opportunity - surface acoustic wave (SAW) devices present the opportunity to perform many nonlinear signal processing functions such as frequency mixing, harmonic generation, signal convolution and correlation, signal storage, and optical imaging and image processing. Such nonlinear functions can most efficiently be performed through the interaction of SAWS with an adjacent semiconductor material. One configuration which allows such an interaction is the monolithic structure of a SAW-supporting piezoelectric and a semiconductor material. The monolithic structure offers the advantages of ruggedness, reproducibility, and compatibility with modern integrated circuit fabrication techniques. Objective - the objective of this work is to improve the operational behavior of the monolithic zinc oxide/silicon dioxide/silicon configuration, a configuration which is being investigated by a number of researchers for its potential as a nonlinear SAW signal processing system. How work contributes - this work will be aimed specifically at blocking and/or controlling charge injection into the zinc oxide, addressing the problems of frequency dispersion, and minimizing sputtering damage when the zinc oxide is deposited.

The zinc oxide/silicon dioxide/silicon structure employs aluminum contacts on the zinc oxide. This combination results in an Ohmic contact which allows the injection of electrons into the zinc oxide under reverse bias conditions. In most applications this situation is undesirable and should be eliminated. In this work the charge injection will be blocked by placing an insulating layer of aluminum oxide or aluminum nitride between the metallization and the zinc oxide. Not only will these insulating layers block the charge injection but they should also be crucial to the control and elimination of dispersion in the monolithic configuration. Problems are also encountered when the sputtering of zinc oxide into the oxidized silicon substrate causes a degradation of the silicon dioxide layer and the silicon/silicon dioxide interface properties. This work proposes to solve this problem by placing a protective layer of material on the silicon dioxide prior to sputtering. (Text abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0013, MULTIPLE NUCLEAR BURST MODELING OF ENERGETIC ELECTRON INJECTION INTO THE MAGNETOSPHERE
K.I. GOLDEN, Northeastern University, School of Engineering, *Boston, Massachusetts* 02115 (DF048440; F19628-76-C-0246)

AF function - survivability of space borne systems. Deficiency -inadequate knowledge of the environment produced by multiple exoatmospheric nuclear bursts and the interaction of the radiation fluxes produced with advanced operational space systems as spelled out in the Air Force requirements document for nuclear weapons research. Research - environmental consequences of multiple nuclear burst and the interaction with space systems. How research contributes - the effects on particle trapping and loss from wave-particle interaction in the plasmas produced by multiple nuclear bursts are determined and the interaction of these radiation fluxes with space system is investigated. The streaming instabilities due to the coupling of collisionless debris plasma to collisional plasma are studied for the situation of a second nuclear explosion occurring inside a magnetic field-free contracting plasma bubble and particle fluxes calculated. The wave modes produced have been identified, and their effects on particle trapping, heating and loss have been studied; these results are being applied to determine their interaction with a high-altitude space system.

Exoatmospheric nuclear burst weapon debris particles injected to high altitudes will experience plasma instabilities between the expanding debris ions and background ionized air neutrals. The resulting energetic electrons will act as a source of electron injection into the van Allen belts. Streaming instability interactions between the expanding debris ions and the background ions generate plasma turbulence. The turbulent modes will stochastically heat the resonant fraction of plasma electrons trapped in the interpenetrating field. The nonlinear wave-resonant particle interaction will determine the electron flux levels experienced by high-altitude satellites. Turbulence will be generated by numerous plasma streaming instability interactions. The research is an analysis of this turbulent collisionless injection mechanism and how it is modified when two or more nuclear devices are detonated in near proximity at high altitude and the nature of the interaction of this injected high-energy plasma and Air Force space systems.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NP, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0014, WIND TUNNEL WALL INTERFERENCE

E.H. DOWELL, Princeton University, School of Engin. & Appl. Sci., *Princeton, New Jersey* 08540 (DF048590; AF-AFOSR-3337-77)

AF function - advanced aerospace vehicles. Deficiency - with the trend towards larger and/or higher performance transonic vehicles, engineering design will have to be reduced to a more rigorous science than is now possible with the present state of knowledge or simulation of transonic flow. Of prime importance for the future will be the ability of the scientist and engineer to obtain model data of unprecedented accuracy in transonic tunnels, thereby minimizing the costly consequences of costly errors in scaling model results to full-scale flight conditions. One of the problems in wind tunnel testing is the magnitude of the wind tunnel wall correction that must be made, particularly for large lift coefficients and/or unsteady (time dependent) flows. Objective - the purpose of this research is to advance the state of the art in analytically modeling the fluid dynamics of the flow about and through transonic wind tunnel walls and thereby provide theoretical guidance as to the magnitude of the wall interference correction as well as to improvements that can be made with designs of new wind tunnel walls. How work contributes - the vehicle designer relies heavily on data obtained in laboratory facilities to either improve or verify his design approach. Of prime importance in using this laboratory data is a firm grip on the exact magnitude of the facility interference on the data obtained. This problem is particularly acute in transonic testing where, in current facilities, significant corrections to the data are needed to account not only for facility artifacts but also scale.

A purely theoretical study wherein an attempt will be made to develop more sophisticated theoretical models of the flow about and/or through transonic wind tunnel walls. Walls to be considered will include solid flexible, slotted and porous configurations. After developing these models theoretical estimates will be made of the interference provided by these walls for two- and three-dimensional flows, both steady and unsteady. The concept of small perturbations of the infinite atmospheric solution will be used to obtain the magnitude of the wall interference.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0015, RADIATION IN MOS/SOS DEVICES

A.K. KOKKAS, Radio Corporation of America, *Princeton, New Jersey* 08540 (DF900310; F19628-76-C-0183)

AF function - weapons delivery. Deficiency or opportunity - current nuclear hardness requirements for semiconductor devices are not being met. Objective - to investigate the effect of processing variables such as oxidation, diffusion, ion implantation, and silicon growth on the radiation characteristics of the silicon sapphire interface. How research contributes - this research will contribute to the development of a radiation-hardened CMOS/COS technology. The results of the process parameter investigation will contribute significantly to optimizing the radiation hardness of silicon on sapphire for use in Air Force space and missile systems.

Special test devices will be fabricated to evaluate the silicon sapphire interface. These will include MIS capacitors using the sapphire substrate as the gate dielectric, JFET's, and MOSGET's. Variations in device process parameters including silicon growth conditions will be correlated with the radiation response of the silicon sapphire interface.

ADDENDA: Supporting agency address is: Rome Air Development Center ETS, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0016, ADAPTIVE ANTENNA ARRAYS FOR AIRCRAFT COMMUNICATIONS

T. COMPTON, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (DN790000; N00019-77-C-0156)

The objective of this program is to investigate techniques for using adaptive antenna concepts appropriate for use in conventional airborne military communication systems to reduce or eliminate signal interference.

Concepts for adding recognition characteristics to conventional amplitude modulated (am), frequency modulated (fm), frequency shift keying (FSK) and single sideband (SSB) modulated systems which will not increase the bandwidth of such systems will be investigated. For am and fm systems primary emphasis will be placed on the possibility of using phase coding techniques for recognition of desired signals. For FSK and SSB systems other coding concepts will be explored.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20360

SUPPORTED BY U.S. Dept. of Defense, Navy

4.0017, EXPERIMENTAL EVALUATION OF SAMPLING BIAS FOR LASER VELOCIMETERS

W.G. TIEDERMAN, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (DF048330; AF-AFOSR-3298-77)

AF function - advance aerospace vehicles. Opportunity - provide accurate velocity measurement by non-intrusive instrumentation even in regions of separated flow. Objective - to remove the ambiguities in laser velocimetry about biased sampling in naturally seeded flows caused by size distribution and velocity of the seed particles. How work contributes - will provide data and data reduction techniques to evaluate the limits of application of the laser velocimeter. This will provide a much-needed information on the utilization of laser velocimeters now in use in Air Force wind tunnels, jet exhaust and rocket plume test facilities.

An experimental program will be conducted to determine the effect of particle arrival rate upon biased sampling and the effect of sb w-versus-fast particles upon the probability of detection. The experiments will be conducted for both 5-10 micron and 0-10 micron seed particle distributions to determine the sensitivity of the threshold detection level to the size distribution of the particle in the flow.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0018, ANALYSIS OF THE STIRLING ENGINE OIL PUMPING RING SEAL

T.G. KEITH, Univ. of Toledo, School of Engineering, *Toledo, Ohio* 43606 (NSG 3156)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0019, RESEARCH STUDY ON MIXER DIODES FOR SUBMILLIMETER APPLICATIONS

R.J. MATTAUCH, Univ. of Virginia, School of Engin. & Appl. Sci., *Charlottesville, Virginia* 22903 (NAS 5-24218)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, A STUDY OF MAGNETOSPHERIC SUBSTORMS

S. AKASOFU, Univ. of Alaska, Geophysical Institute, *Fairbanks, Alaska* 99701 (ATM74-23832 A02)

This three-year continuing grant supports a study of magnetospheric substorms, the dynamic behavior of that region of near-earth space called the earth's magnetosphere. In the next several years it should be possible to determine missing links among substorm processes which have already been found, and to uncover the sequence of processes which cause the magnetospheric substorm.

One of the most puzzling features during the magnetospheric substorms is the phenomenon called the plasma sheet thinning. Since this occurs during the expansive phase, it is diffucult to explain the whole substorm phenomenon only in terms of an enhanced merging rate near the far end of the magnetotail. It has been suggested that these two apparently contradicting phenomena may be explained by supposing that a new neutral line is formed deep in the magnetotail. This group plans to investigate in great detail both the magnetic field and plasma sheet variations in the magnetotail in conjunction with auroral data taken from the Alaska meridian and elsewhere, as well as from the DAPP and ISIS-2 satellites.

The substorm is also associated with the appearance of an intense westward current along the midnight part of the auroral oval. Since it has become evident that discrete auroras are associated with an intense upward current, it is important to find the cause of enhancement of the current system which includes the electrojet. This group plans to examine relationships between field-aligned currents and the electrojet and also the geometry of the three-dimensional current system.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0002, LUNAR CONSORTIUM

L.A. SODERBLOM, U.S. Dept. of The Interior, Geological Survey, *Flagstaff, Arizona* 86001 (9580-01327)

The principal thrust this year will be to develop, refine and apply correlation techniques. Major question include: (1) Should all variables correlated be of similar resolution (requires smoothing of the higher resolution components)? (2) To what extent can high-resolution maps be used to subdivide low-resolution maps before statistical smoothing (e.g. subdivide raw gamma-ray maps on the basis of colorimetric provinces before smoothing)? In this way the 'resolution' of the data set requiring smoothing can be preserved. (3) Can boundaries between provinces of grossly differing chemical or physical character be recognized and removed from the interpolate image and thereby from the correlation? Otherwise non-existent mixtures are included.

A secondary thrust this year will be to continue research on special techniques for individual data sets. Examples include: (1) Trade-off studies between statistics and resolution, in variables (e.g. gamma-ray), involving counting statistics. (2) Development of orbit-to-orbit noise filters for data sensitive to intra-orbit errors (e.g. X-ray fluorescence). (3) Model studies of magnetic and gravity data using filtering techniques to change relative weights of different harmonics, for example, to model gravity from altimetry files.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0003, A STUDY OF MAGNETOSPHERIC DYNAMICS (PRECIPITATION OVER THE POLAR REGIONS AND THE DAYSIDE CUSP)

K.A. ANDERSON, Univ. of California, School of Letters & Science, *Berkeley, California* 94720 (ATM75-02621 A01)

This grant will support a study of magnetospheric dynamics by using simultaneous auroral scanner, low-energy electron precipitation and plasma data from the USAF weather satellites DMSP system during the period of the International Magnetospheric Study (IMS). The intensity and spectrum of the precipitation characteristics of different types of auroral forms and activities will be determined. The results will enable the principal investigator to infer the particle precipitations based on the auroral photographs from polar orbiting satellites, and this eventually leads to the remote sensing of the instantaneous particle and energy precipitations over the entire polar region. In order to determine the plasma sources, the location of the acceleration region and properties of wave-particle scattering mechanisms for different types of the aurora and over polar regions, simultaneous conjugate observations (i.e., along the same geomagnetic field line) of the ATS-6, ISEE A and B and other IMP series of satellites will be examined with the DMSP optical and particle measurements. The study of magnetospheric dynamics associated with the substorm activity and the variation of the interplanetary field and the topology of the polar cap field lines will also be explored by using low-energy solar electrons observed over the polar cap regions.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0004, MARINE FOG DISPERSAL

H. LOOS, Laguna Research Laboratory, *Laguna Beach, California* 92651 (DN675222; N00014-76-C-0436)

The objective of this research is to design a fog dissipation method based on charged droplet coalescence mechanisms derived from fundamental theory of electrical processes in warm fog. The objective would include suggestions of needed new technology, particularly of nozzle and charging requirements.

All mechanisms will be reviewed which have possible application to fog dispersal methods. These reviewed mechanisms will be placed in context of dispersal methods which have been proposed or which come to mind. By placing these mechanisms together in context and by imposing reasonable system requirements, certain parameter restrictions will become apparent, and make possible evaluation of the importance of the various mechanisms.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense, Navy

5.0005, REMOTE SENSING APPLICATION

D. BERAN, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8AA7 06 20)

PROJECT OBJECTIVE: To further the development and application of remote sensing devices, specifically for use in airport meteorology.

CURRENT YEAR PLAN: To complete preliminary study phase on the use of coherent lidar and to explore the potential of this device for ground-based remote measurements.

PROGRESS REPORT: Preliminary coherent lidar study was started. An outside contractor was selected for consultation on hardware aspects.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0006, ACOUSTIC DOPPLER WIND SENSING AT THE SOUTH POLE

C.G. LITTLE, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (DPP77-04865)

The proposed work is for the development of a three-axis acoustic Doppler wind sensing system for antarctic boundary layer studies, the installation of the system at South Pole Station, and the analysis of the measurements obtained there. The project will extend the climatology of the inversion layer, and provide essential information on the relation of the wind profile to the surface stress and a measure of the momentum flux at internal wave scales.

The field phase of this project will be carried out by two persons at South Pole Station in the austral summer 1977-78, with one person wintering over in 1978.

SUPPORTED BY U.S. National Science Foundation, Div. of Polar Programs

5.0007, A FIELD EXPERIMENT DESIGN TO DETERMINE THE EXTENDED AREA OF EFFECT FROM WINTERTIME CLOUD SEEDING

L.O. GRANT, Colorado State University, School of Engineering, *Fort Collins, Colorado* 80521 (ENV76-83893)

The application of weather modification technology is repeatedly faced with the concern over misappropriating water from areas downwind of the intended target. Past research has shown that precipitation increases of 15% to more than 100% may occur in areas up to several hundred kilometers downwind of intended cloud seeding target areas. An unbiased test for these effects requires a field experiment specifically designed to address this problem.

This study is developing a field experiment design for determining the effect of wintertime cloud seeding for extended areas downing of primary targets in the Rocky Mountains. A preliminary design is being refined by computer model simulations of airflow, cloud and precipitation processes and by field measurements which clarify the physical hypotheses to be tested in the experiment. Tracer and modeling studies are being used to optimize the siting of seeding generators and precipitation measurement networks. The discriminative capabilities of radar and aircraft instruments are being tested for their use in physical studies.

Due to the important societal implications of the extended area effects, societal concerns will be included in the overall experimental design. A societal task group is participating in the design study to develop a plan for the societal studies needed to complement the physical science experiment, including integrated studies involving economics, sociology, political science, law and the environmental sciences.

SUPPORTED BY U.S. National Science Foundation, Div. of Advanced Environmental Research & Technology

5.0008, SATELLITE SURVEILLANCE OF COASTAL ENVIRONMENT AND MONITORING OF SLUDGE DUMP SITES

V. KLEMAS, Univ. of Delaware, School of Arts & Sciences, *Newark, Delaware* 19711 (NSG 1433)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0009, ELECTRON SCATTERING FOR AIR POLLUTION

S.R. MIELCZAREK, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234 (2320151)

PURPOSE: To develop advanced measurement techniques, using electrons, to detect and characterize constituents of a polluted atmosphere, and to provide methods of obtaining data crucial to atmospheric modeling.

OBJECTIVES: To develop technology to permit measurements of the energy absorption characteristics of atmospheric constituents by electron impact determination of generalized oscillator strengths, and to extend the technology for trace analysis where warranted. To establish methods of determining the forbidden states in atmospheric molecules as required to model atmospheric chemical reactions.

FY77 MILESTONES: Develop a system for making generalized oscillator strength measurements, and use it on the freons as part of a task to be completed by October 1979. Publish a review of electron scattering (February 1977).

ACCOMPLISHMENTS: Excitation function measurements of xenon to aid laser fusion development. Modified scattering cell to permit temperature-dependent scattering studies. Verified NO in N2 SRM by independent technique. Measured and published generalized oscillator strengths for O2 and N2O to aid atmospheric modeling.

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards

5.0010, USE OF SATELLITE DATA IN NUMERICAL WEATHER PREDICTION OVER THE TROPICS

T.N. KRISHNAMURTI, State University of Fla. Sys., School of Arts & Sciences, *Tallahassee, Florida* 32306 (8-211; 04-5-158-26 Mod. No. 2)

The objective of this project is the use of satellite data collected during the GATE period (Summer, 1974) in conjunction with a numerical weather prediction model. Two specific phases of the investigation preparatory to application of the prediction model can be identified: 1. Collection and analysis of high- and low-level wind fields during the GATE period. This phase has been completed. 2. Analysis of sea surface temperature and rainfall data and their application to the parameterization of cumulus convection. This phase has been completed with the production of an Atlas of sea surface temperature.

Numerical prediction experiments using the GATE data have been conducted on the period July 11 through 15, 1975, and a report is in preparation. Particular attention is directed to the radiative heat balance over the Sahara as it effects the development of disturbances over the GATE area. Further experiments are planned focusing on sensitivity to change in sea surface temperature.

Future work includes improved moisture analysis over the oceans using data from Nimbus 6 and animated films of the short-term tropical climate over the past 20 years.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0011, FIELD MEASUREMENTS OF MESOSCALE WEATHER SYSTEMS

J.J. STEPHENS, State University of Fla. Sys., School of Arts & Sciences, *Tallahassee, Florida* 32306 (ATM77-04285)

The objective of this research is field observations of severe storms with the data analysis aimed at optimizing sampling patterns and observing platforms for future experiments on this scale of motion. To an extent, observational definition of mesoscale phenomena has lagged for lack of comprehensive and skilled sampling, and in recent years this has led to suggestions for major national programs aimed at this scale of motion; for example, the Severe Environmental Storm and Mesoscale Experiment (SESAME). Major experiments such as these require formalized experimental design for success. This research will investigate aspects of such experimental design by using as a base various observational programs which will be brought together in the spring of 1977 to study severe storms in Oklahoma in the vicinity of the National Severe Storms Laboratory of the National Oceanic and Atmospheric Administration (NOAA). The research will involve the use of the NCAR C-band radar and the Portable Automated Mesonet. Associated programs will involve the NCAR Queen Air aircraft and the major radar systems available at the NSSL. Primary emphasis in the analysis phase will be upon optimum experimental design for multiple Doppler arrays and for the placement of surface stations for the observation of mesoscale and associated severe storm systems. The procedure is based on analyzing the observations by means of a multivariate statistical objective analysis and a subsequent variational adjustment to a suitable system of constraints. For example, the analysis of surface data constraints would include the equations of motions, energy conservation and continuity. Continuity and scan/sampling restrictions will be used for the N-Doppler array. This should lead to plans for sensor employment based on minimizing the total error in the observation/analysis procedure.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0012, GLOBAL ATMOSPHERIC MEASUREMENTS EXPERIMENT ON TROPOSPHERIC AEROSOLS AND GASES (GAMETAG)

D.D. DAVIS, Georgia Inst. of Technology, Graduate School, *Atlanta, Georgia* 30332 (ATM76-81487)

Using the NCAR (National Center for Atmospheric Research) Electra as a sampling platform, a global sampling effort will be initiated which will involve the measurement of over 50 atmospheric species and meteorological parameters on a simultane-

ous basis. Recognizing both the importance of chemically coupled atmospheric species and the strong interaction between chemistry and meteorology, the GAMETAG (Global Atmospheric Measurements Experiment on Tropospheric Aerosols and Gases) program is to be a joint effort among meteorologists, cloud physicists, and atmospheric chemists. Project GAMETAG calls for a seven-year project which is to be divided into two phases of two and five years duration. Phase I of the project, the objective of this grant, will have as its primary objective the elucidation of the importance of the hydroxyl free radical to tropospheric chemistry. In addition, there are two secondary objectives for Phase I: (1) an assessment of the global tropospheric budgets for halocarbons, ozone, and sulfur, carbon, and nitrogen species; and (2) a minor effort aimed at assessing the levels and types of natural tropospheric aerosols.

At least two major GAMETAG flights per year are scheduled. These flights, during the first two years of the program, are expected to span a global latitude range of 75 degrees N to 55 degrees S and a longitude range of 165 degrees - 30 degrees in the western hemisphere. The general sampling plan for GAMETAG will include representative transit flights into Polar, Tropical, and Transition air masses which have been modified both by continents and oceans and by large-scale ascent and descent.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0013, INITIAL PHASE OF STUDY OF LIGHTNING TRANSIENTS ON BURIED CABLE

J.A. WOODY, Georgia Inst. of Technology, Graduate School, *Atlanta, Georgia* 30332 (NAS10-9210)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0014, TIDES AND SEA-LEVEL STUDIES

G.W. GROVES, Univ. of Hawaii, School of Arts & Sciences, *Honolulu, Hawaii* 96822 (OCE77-17566)

This project will carry out theoretical studies of the tidal response of the ocean. The effects of solar radiation on sea level and improved representation of nonlinear interactions will be investigated. Particular attention will be paid to analysis, prediction, and comparison of the theory with data free from a variety of areas.

SUPPORTED BY U.S. National Science Foundation, Div. of Ocean Sciences

5.0015, NORTH PACIFIC EXPERIMENT (NORPAX) - PACIFIC CLOUDINESS AND ATMOSPHERIC ANOMALIES

J.C. SADLER, Univ. of Hawaii, School of Arts & Sciences, *Honolulu, Hawaii* 96822 (OCE74-13737 A02)

The North Pacific Experiment (NORPAX) is a large, multi-institutional research project directed toward 1) the study of anomalously warm and cold pools of water in the upper layers of the ocean and 2) the determination of the possible relationship between these pools and changes in the world's climate. As part of NORPAX, this grant will provide for two general tasks. The first task will be the processing and archiving of satellite cloudiness data and basic statistics for the Pacific Ocean from 1973 till the present. Similar data extending from 1965, the beginning of satellite meteorology, through 1973 are already in hand. The second task will be to utilize the cloudiness data to spot anomalous heating of the atmosphere in the equatorial zone and consequent climate effects at higher latitudes.

SUPPORTED BY U.S. National Science Foundation, Div. of Ocean Sciences

5.0016, DOPPLER RADAR STUDIES OF STRATIFORM PRECIPITATION

R.C. SRIVASTAVA, Univ. of Chicago, Graduate School, *Chicago, Illinois* 60637 (ATM77-12616)

It is proposed to analyze and interpret Doppler radar data for three meteorological situations. These are: (1) a case of primarily stratiform precipitation associated with a 'warm' frontal passage and exhibiting a 'bright' band. The objective is to describe and understand the three-dimensional wind and reflectivity fields associated with the front, and mesoscale wind perturbations associated with the melting process, (2) a situation of snow in the form of persistent bands. The objective is to try to understand the physical mechanism underlying the maintenance of the bands, by an analysis of radar deduced three-dimensional fields of wind and reflectivity, and (3) a case of relatively homogeneous snow. The objective is to use conical scan data to calculate parameters of the turbulence in the precipitation layers. Data for these three situations are already available.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0017, VERTEBRATE POPULATION ECOLOGY AND MANAGEMENT

H.L. ARCHIBALD, Purdue University, Agric. Experiment Station, *Lafayette, Indiana* 47907 (0062269; IND059036)

OBJECTIVE: Develop improved methods for censusing vertebrate populations. Characterize spatial distribution as influenced by management strategies. Investigate ecological relationships. Develop strategies for manipulating terrestrial ecosystems.

APPROACH: Adapt thermal scanners and other remote sensing equipment to problems of censusing, sampling, and distribution. Secure data on population density, age structure, reproduction, mortality, movement, food habits, habitat use and behavior. Construct models from these data and devise management technics.

PROGRESS: Despite numerous attempts at a casual explanation, none of the hypotheses put forth adequately accounts for the 10-year wildlife population cycle. Peak years of animal abundance were predicted with a model based on the nodal cycle of the moon. The textbook period of the nodal cycle is 18.6 years, but there are 9.3-year cycles in certain phenomena such as retardation in time of moonrise at full moon near the vernal equinox. The period and phase of the latter comprised the parameters of the model. Predictions were compared with reported peak years for Canada lynx (Lynx canadensis), snowshoe hares (Lepus americanus), and ruffed grouse (Bonasa umbellus). For the period 1829-1950, the average difference between reported and predicted peaks of abundance was 0.30 years (n equals 14, s.d. equals 0.804). This correlation suggests but cannot prove the new hypothesis that the nodal cycle is the factor underlying the 10-year cycle. An important advantage of this hypothesis is that it accounts for the regularity of the period, geographic extent, and approximate synchronization within and between species. While the model has value as a predictive tool, the hypothesis must be considered tentative until the mechanism(s) can be documented. If the mechanism involves an indirect lunar effect on plants or weather rather than a direct effect limited to cyclic animals, the implications could have profound significance.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Indiana

5.0018, FALLOUT WINDS FROM SATELLITE RADIANCE OBSERVATIONS

G. OHRING, Tel Aviv University, *Tel Aviv, Israel* (DA0D9338; DAERO 77 G0051)

The major prupose of the proposed research program is to develop and test techniques for inferring effective fallout winds directly from mix of satellite radiance and conventional (radiosonde) observations.

The proposed technique should enable a simple, quick, direct transformation of the satellite radiance observations to effective fallout wind. The research will test and validate the technique on the sets of satellite and conventional (radiosonde) data available for White Sands Missile Range before testing the technique on field operational satellite and conventional observations.

ADDENDA: Supporting agency address is: DARCOM R&S GP (EUR), Box 65 FPO NY 09510

SUPPORTED BY U.S. Dept. of Defense, Army

5.0019, ASSESSMENT OF WIND EROSION DAMAGE AND ENVIRONMENTAL IMPACT
N.P. WOODRUFF, Kansas State University, U.S.D.A. Agric. Res. Service, *Manhattan, Kansas* 66504 (0042273; 3707-15080-004)

OBJECTIVE: Provide quantitative information on impact of soil blowing on soil productivity, crop yields, air quality, mechanical devices, transportation, and human and livestock health.

APPROACH: Determine plant physiological effects of and tolerance to windblown soil, and develop field methods to assess yield depression. Measure erosion-caused soil changes on benchmark soils and relate to soil productivity and crop yields. Measure airborne dust from wind erosion and develop standards for reporting it. Develop wind erosion monitoring samplers and use remote sensing for large-scale monitoring. Determine impact of windblown soil on highway travel, on machinery, on pesticide transport, and on human and livestock health. Use human behavioral studies to determine farmer perception of wind erosion.

PROGRESS: A procedure utilizing the wind erosion equation to estimate annual soil loss and topsoil removal-crop yield relationships to convert soil losses to crop yield has been developed to quantify loss in productivity from wind erosion. Estimates for 13 southwestern Kansas counties indicate annual yield reductions of 339,000 bushels of wheat and 543,000 bushels of grain sorghum on 1,200,000 acres of sandy soils. Chlorophyll assay has shown no promise as a method of predicting the effect of sandblast injury to plant seedlings on final crop production. Measurements of chlorophyll content of tomatoes after sandblasting showed it correlated with fresh and dry weight of plants 10 days after exposure but not with final yield. No discernible differences have been found in damage suffered by different aged onions and grain sorghum due to wind and sandblasting. Blasts exposed at ages of 3, 7, 14, 21, and 35 days showed benefits from wind only, reduced height of sorghum by sandblasting, but no difference in effect related to plant age.

SUPPORTED BY U.S. Dept. of Agriculture, Agricultural Research Service, Kansas - Nebraska Area

5.0020, MERCURY GEOLOGIC MAPPING - KUIPER QUADRANGLE
R.A. DEHON, Northeast La. University, Graduate School, *Monroe, Louisiana* 71201 (NSG 7357)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0021, THEORETICAL CALCULATIONS OF NON-BALLISTIC FLUID DYNAMIC FLOW FOR EJECTA TRANSPORT IN MODELS OF MULTIRING BASINS OF IMPACT ORIGIN
S.I. PAI, Univ. of Maryland, Inst. for Fluid Dyn. & Math., *College Park, Maryland* 20742 (NSG 7365)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0022, NATURALLY AND ARTIFICIALLY STIMULATED ELECTRON PRECIPITATION NEAR THE PLASMAPAUSE
T.J. ROSENBERG, Univ. of Maryland, Inst. for Fluid Dyn. & Math., *College Park, Maryland* 20742 (DPP76-82041)

In this research project, naturally and artificially stimulated electron precipitation near the plasmapause will be investigated. The principal measurements will be of bremsstrahlung X-rays using balloon-borne scintillation counters. Complementary measurements of VLF emmissions and possible DC electric field measurements will also be included on a number of flights.

The balloon-borne measurements will be carried out at Roberval, Canada, in the summer of 1977 and from Siple Station, Antarctica, in the austral summer of 1978/79. The measurements at Siple will be part of a combined rocket-balloon-satellite and ground-based study of Very-Low-Frequency-Wave and particle interactions which is jointly sponsored by NSF and NASA.

Logistics support is required for three persons plus associated scientific equipment at Siple Station, Antarctica, during the austral summer of 1978/79.

SUPPORTED BY U.S. National Science Foundation, Div. of Polar Programs

5.0023, SATELLITE DENSITY MEASUREMENTS USING IONIZATION GAUGES AND LASER SOUNDING
J.P. MCISAAC, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249440)

AF function - low-altitude operational satellites, airborne surveillance, ballistic nuclear weapon delivery. Deficiency -inaccuracies in the determination of low-altitude satellite ephemerides due to inadequate data on density variations at critical altitudes. Objective - acquisition of atmospheric density measurements on a global scale. To define, correlate and/or empirically relate results with solar and geophysical phenomena. How research contributes - permits direct accurate measurements of density used in the development and upgrading of forecasting techniques.

Inflight measurements of atmospheric density will be performed onboard the S77-2 spacecraft. Along with direct measurements with improved ionization gauge instrumentation, a newly developed particle flux accumulator sensor (PFA) has been developed and will be flight tested on the S77-2 flight. This instrument has the capability of measuring vehicle attack angle and atmospheric temperature in addition to density. Data acquisition from the S3-2 satellite continues and reduction techniques initiated. Analysis programs for use with the s3-1 data base are being developed which will allow correlative and interpretive studies to be performed, permitting a more comprehensive evaluation of model deficiencies. As more measurements from future spacecraft flights are accumulated, this data base will be supplemented with results obtained during the maximum phase of the solar cycle. Remote sounding techniques utilizing laser technology are being developed for satellite density measurements.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory LK Hanscom AFB, Bedford, MASS 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0024, ARIES ROCKET FLIGHT ENVIRONMENT
R.G. STEEVES, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249750)

AF function - probing the aerospace environment. Deficiency or opportunity - the ARIES flight environment is largely unknown. Objective - gather in-flight environmental data for ARIES rocket payloads. How research contributes - provides data on boost and post-boost phase of flight to set environmental design, testing, and operating standards for scientific instrumentation to be flown on ARIES.

A system will be designed and assembled independent of other rocket instrumentation to measure in-flight vibration and temperature data. Data gathered from a minimum of 3 vibration transducers will be analyzed after each of three flights. Critical temperatures will be measured and telemetered.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory LCR, Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0025, RADAR OBSERVATIONS AND ANALYSIS OF PRECIPITATION PATTERNS
P.M. AUSTIN, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (ATM75-14135 A02)

The aim of the research is to observe the structure of precipitation in various types, to extract statistics regarding characteristics and behavior of subsynoptic-scale precipitation areas and to interpret observed patterns in terms of associated small-scale circulations.

The work will use a 5-cm radar and digital data processing system, which were acquired for observing tropical showers in GATE, in conjunction with the 10-cm radar previously in opera-

tion at MIT to obtain extensive digital data in New England storms. Both these data and the large amounts obtained in GATE will be used in a variety of studies.

The proposed analyses include: (1) Definition of cells and of mesoscale precipitation areas and bands in terms of parameters which permit identification and tracking by computer; (2) Further exploration of the characteristics and behavior of subsynoptic-scale precipitation areas; (3) Development of kinematic models to compute three-dimensional distribution of radar reflectivity; (4) Statistics of the small-scale distribution of precipitation; (5) Evaluation of attenuation of 5-cm radiation by rain; (6) Examination of the dependence of measured reflectivities on range; (7) Continuation of analysis of drop-size measurements and Z-R relations; (8) Case studies of selected situations in the GATE area and in New England.

In particular, consideration will be given to well-defined narrow bands and to computations of vertical transports by cumulus cells.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0026, VERTICAL SOUNDING ERRORS
UNKNOWN, Geo Atmospherics Corporation, *Lincoln*, *Massachusetts* 01773 (DF248610; F19628-77-C-0118)

AF function - weather analysis and forecasting for military operations. Deficiency - inability to determine meteorological conditions over inaccessible or unfriendly territory, especially over water. Objective - to develop techniques to improve the accuracy of vertical profiling based on the use of the defense meteorological satellite. How development contributes - improves the ability to infer and forecast atmospheric temperature and humidity profiles from satellite observations.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory LY Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0027, IMAGING ALL-SKY PHOTOMETER
R.H. EATHER, Keo Consultants, *Newton*, *Massachusetts* (DF249780; F19628-76-C-0168)

AF function - communications and detection. Deficiency - understanding effects both of precipitating particle and non-particle produced ionospheric disturbances which degrade communications at high and equatorial magnetic latitudes. Objective - investigate ionospheric disturbance phenomena by means of auroral spectral emission features measured with a sensitive TV system. How research contributes -provides a new and powerful technique for large-scale and high-time-resolution auroral measurements. Coordination with other simultaneous measurements from the AFCRL Airborne Ionospheric Observatory, NKC-135 aircraft number 53131, will allow comprehensive measurements of ionospheric response to substorms over subauroral, auroral and polar cap domains.

Design, develop and construct an ultra-high-sensitivity, low-light-level TV system capable of wavelength discrimination, all-sky viewing and signal processing to accurately measure auroral emissions in the visible region of the spectrum.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH, Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0028, ANALYSIS OF ATMOSPHERIC SENSOR DATA
UNKNOWN, R D P Incorporated, *Waltham*, *Massachusetts* (DF248190; F19628-77-C-0167)

AF function - communications, surveillance and navigation in the upper atmosphere. Deficiency - lack of knowledge of disturbed ionosphere for possible circumvention. Research - analysis of experimental data from rockets flown through various categories of quiet and disturbed ionosphere. How research contributes - augments knowledge on the prediction of radio wave propagation with emphasis on the polar regions. Data obtained from rocket-borne experiments such as electron and ion density, temperature, electron energy distribution, vehicle potential in the d and e regions during varying conditions is analyzed leading to tabular results of the critical parameters upon which avenues of advanced analysis can be taken. The first-order results of the data analysis have as outputs plots and digital tapes.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory SU Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0029, A STUDY OF THE GULF STREAM USING SATELLITE-TRACKED, DROGUED SURFACE BUOYS
P.L. RICHARDSON, Woods Hole Oceanographic Inst., *Woods Hole*, *Massachusetts* 02543 (OCE77-08045)

This project will investigate the general problem of where the Gulf Stream goes and how it breaks down after it passes the Grand Banks. Recent studies disagree on whether the Gulf Stream splits into two or more identifiable components or whether it remains a single current, and spreads into the eastern portion of the North Atlantic subtropical gyre. In this project, six drogued surface buoys, tracked by the Nimbus F satellite, will be deployed, four in the Gulf Stream along longitude 55 degrees W, and two in Gulf Stream eddies between 40 degrees and 55 degrees W.

SUPPORTED BY U.S. National Science Foundation, Div. of Ocean Sciences

5.0030, REMOTE SENSING INFORMATION AND ANALYSIS
J.D. COOK, Environmental Res. Inst. Mich., *Ann Arbor*, *Michigan* 48107 (DF041620; AF-AFOSR-2897-75)

The USAF and its operations contribute to and affect the quality of the atmospheric environment. To better understand this relationship and to maintain cognizance of what other agencies are accomplishing, AFOSR needs the capability to evaluate the many new instrumental techniques, developments, and applications. This evaluation and analysis, to be performed by the Remote Sensing Center will provide the program manager with the necessary data to make an effective and timely assessment of what research the USAF should support and its effects on the atmospheric environment.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NP, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0031, NEUTRAL CONSTITUENT MEASUREMENTS IN THE STRATOSPHERE
K. MAUERSBERGER, Univ. of Minnesota, Inst. of Technology, *Minneapolis*, *Minnesota* 55455 (NSG 1431)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0032, THE OCCURRENCE OF URANIUM IN NEW HAMPSHIRE
G.W. STEWART, Univ. of New Hampshire, Graduate School, *Durham*, *New Hampshire* 03824 (14-08-0001-G-276)

STATE TO WHICH PROJECT PERTAINS: New Hampshire.

Continue reconnaissance mapping, ground radiometry, and sampling in the contact zone of the Conway Granite and associated Pleistocene deposits to determine the uranium and thorium mineralization potential in hydrothermal and placer environments. Synthesize the geometry and structural setting of the Lake Sunapee autunite deposit and provide a rationale for a reconnaissance core drilling program. Complete an analysis of the remote sensing imagery available for New Hampshire. Prepare a final report on the project documenting the environments of deposition of uranium and thorium minerals in New Hampshire.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0033, NAVY ENVIRONMENT - AIRBORNE RADAR PROFILING OF FIRST-YEAR AND MULTI-YEAR SEA ICE THICKNESS

A. KOVACS, U.S. Army, Cold Reg. Res. & Engin. Lab., *Hanover, New Hampshire* 03755 (DN775324; N00014-77-MP-70016)

To develop a method of determining, by remote sensing, the thickness, top and bottom profile, effective dielectric constant, and the electromagnetic impulse velocity of first-year and multi-year sea ice, using a dual-antenna impulse radar system; and to develop data processing techniques to aid in analyzing and interpreting the data output from the system, and in constructing surface and subsurface reliefs of the sea profiled.

A helicopter-borne dual-antenna impulse radar system will be used to profile first-year and multi-year sea ice at various altitudes and speeds. Similar profiles will be obtained by ground transport of the radar system for comparative purposes. Numerous drill hole measurements will be taken over the areas profiled, such that actual ice depth can be compared with depth measurements obtained by the system. The data will be recorded on a graphic recorder and an analogue tape, which will then be computer-analyzed to obtain exact signal travel times, from which ice thickness measurements can be calculated. Utilizing this data, techniques for constructing a cross section of the ice profiled, which can be used in model studies of heat exchange between the ocean and atmosphere, studies of under-ice roughness, oil entrapment, etc., will be developed.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense, Navy

5.0034, STUDIES OF THE ARECIBO IONOSPHERE

D.T. FARLEY, Cornell University, School of Electrical Engin., *Ithaca, New York* 14850 (ATM75-03882 A01)

This grant funds an assemblage of theoretical and experimental studies of the Earth's atmosphere using the incoherent scatter radar at the National Astronomy and Ionosphere Center at Arecibo, Puerto Rico. In particular it funds research in the following areas: 1. observations of the nighttime ionospheric E-region; 2. observations of proton and oxygen ion velocities; 3. theoretical studies of photoelectron production and loss; 4. improvement of procedures for reducing and analyzing incoherent scatter data; 5. measurements of troposheric and stratospheric wind profiles; 6. two-frequency measurements of the ion-neutral collision frequency. This grant continues research pursued under NSF grant No. ATM-75-03881.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0035, ANALYSIS OF EROSION AND TRANSPORTATION FEATURES FROM LUNAR ORBITER AND APOLLO PHOTOGRAPHY

T. GOLD, Cornell University, School of Physical Sciences, *Ithaca, New York* 14850 (NSG 7348)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0036, EARTHQUAKE RELEVANCE TO THE TECTONICS AND STRUCTURE OF THE PHILIPPINES-HALMAHERA-CELEBES-JAVA-WESTERN NEW GUINEA REGION (ABBREV)

B.L. ISACKS, Cornell University, School of Arts & Sciences, *Ithaca, New York* 14853 (OCE75-21240 A01)

The Cornell group request support for the second of a three-year project to relate the earthquake data to the tectonic and structural geology in southeast Asia. During the first year all available earthquake data were evaluated and plotted on maps and sections. In addition all available focal mechanism solutions were compiled. For the second year detailed study will be made of seismically active complex parts of the region in order to understand the fault patterns and movement of the subduction zone. Some attempt will be made to delineate the thermally active regions of the upper crust and mantle. The fault pattern and other tectonic features will be examined in the light of LANDSAT (satellite) imagery. Such investigations are fundamental to understanding the regional geology of this complex area.

SUPPORTED BY U.S. National Science Foundation, Div. of Ocean Sciences

5.0037, PLASMA INSTABILITIES IN THE EARTH'S IONOSPHERE AND MAGNETOSPHERE

R.N. SUDAN, Cornell University, School of Engineering, *Ithaca, New York* 14850 (ATM75-02797 A02)

The objective of this research is the theoretical investigation of those plasma instabilities and their nonlinear behavior that cause some of the phenomena originating in the ionosphere and magnetosphere. Phenomena of importance include E-layer irregularities in the equatorial electrojet as well as some F-region irregularities. The technique will eventually be applied to auroral problems.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0038, FURTHER DEVELOPMENT OF SWEEP-FREQUENCY ELECTROMAGNETICS FOR MINERAL EXPLORATION

J.T. KUO, Columbia University, School of Mines, *New York, New York* 10027 (EAR76-24383)

This is a project to develop a sweep-frequency electromagnetic method for the exploration of mineral resources. The method utilizes the spectral behavior of the secondary electromagnetic field due to a harmonic electromagnetic source of continuously varying frequency (sweep signal). Compared with the conventional single-frequency data, the sweep-frequency data covering several decades of source frequency contain theoretically all the possible electromagnetic information pertaining to mineral exploration. The resultant two-dimensional spectral profile, i.e., spectral response versus distance, facilitates the recognition of a quality anomaly and its definitive interpretation in terms of subsurface structural and physical properties. The method can be readily adapted to a fast and economical airborne operation for either reconnaissance or detailed exploration. The massive raw data will allow statistical data processing through playback. The results of this research are expected to greatly improve the state of the electromagnetic method in locating ambiguous and deep-seated mineral deposits, which may easily pass unnoticed with the conventional electromagnetic method.

SUPPORTED BY U.S. National Science Foundation, Div. of Earth Sciences

5.0039, INVESTIGATION OF PLANETARY-SCALE FLUCTUATIONS OF THE ATMOSPHERE

R.J. DELAND, New York University, School of Arts & Sciences, *New York, New York* 10012 (ATM77-07094)

The structure and dynamics of planetary-scale fluctuations of the atmosphere are the basic objectives of this research. The analysis is based on global observations of isobaric geopotential and temperature, augmented by satellite measurements of the thermal radiance in narrow spectral bands, from which atmospheric temperature is deduced by regression relations between radiances and temperatures.

The work has two main objectives: deduction from statistical results of models of the atmosphere's planetary-scale behavior that satisfy the physical constraints, and estimation of upward energy transport associated with the fluctuating planetary-scale waves and variations of the zonal wind.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0040, AN INVESTIGATION OF NONTORNADIC SEVERE THUNDERSTORMS

H. BLUESTEIN, Univ. of Oklahoma, Office of Research Admin., *Norman, Oklahoma* 73069 (ATM77-17865)

The objective of this research is the structure of nontornadic severe thunderstorms occurring over the National Severe Storms

Laboratory (NSSL) multiple Doppler radar network. Most previous studies have been of tornadic thunderstorms. Differences will be sought between the structure of nontornadic and tornadic thunderstorms. If there are differences, some insight into the dynamics of tornado formation may be achieved along with some improvement in short-term tornado forecasting. Otherwise, it may be concluded that smaller-scale observations are needed. Both subjective and objective data analysis techniques will be used. Several suitable data sets from previous years are available from NSSL. Some new data from the spring 1977 field effort, in which at least three Doppler radars will be used, may be analyzed also.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0041, PRECIPITATION CHARACTERISTICS FROM DUAL-WAVELENGTH DOPPLER RADARS
G.B. WALKER, Univ. of Oklahoma, School of Electrical Engin., *Norman, Oklahoma* 73069 (ATM76-19791)

The measurement of vertical wind velocity and dropsize distributions in precipitating regions of storm systems has been of great interest in recent years. However, accuracy in the estimate of these quantities has been limited by the need to make an assumption about one parameter to determine the other, thus limiting the utility of the results. Recently, it has been theoretically shown that use of multiple wavelength Doppler radars can provide independent estimates of vertical wind and dropsize distributions. Indeed, it is possible to estimate turbulence as well.

This research is proposed to estimate the vertical wind, dropsize distribution, and spectrum broadening effects, such as due to turbulence, from a vertically looking dual-wavelength Doppler radar system. The experimental research proposed would use primarily existing equipment. Results obtained will be compared with other vertical wind and dropsize distributions measuring techniques.

The estimation of parameters above is based on a unique relationship between the fall velocity power spectra ratio from two different wavelengths and the radar scattering cross-section ratio versus dropsize for the appropriate temperature. The latter ratio curve can be used to estimate the vertical wind and dropsize distribution in a radar pulse volume. Turbulence, which broadens the velocity power spectrum, can be estimated by deconvolving the turbulence broadened spectrum, and the vertical velocity dropsize distribution subsequently defined.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0042, RESEARCH OF THE NATURE AND SUBSURFACE CHARACTER OF LINEAMENTS IN PENNSYLVANIA
S.S. ALEXANDER, Penn. State University, School of Earth & Min. Sci., *University Park, Pennsylvania* 16802 (NSG 5185)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0043, ICE CHAMBERS DESIGN AND WARM FOG MICROPHYSICS APPLICABLE TO UNDERSTANDING FLIGHT EXPERIMENTS UNDER LOW-GRAVITY CONDITIONS (ABBREV)
V. KELLER, Univ. of Tennessee, Graduate School, *Knoxville, Tennessee* 37916 (NAS 8-32611)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0044, ATMOSPHERE EXPLORER DATA ANALYSIS AND ELECTRODYNAMICS EXPLORER INSTRUMENT DEVELOPMENT
J.L. BURCH, Univ. of Texas, Graduate School, *San Antonio, Texas* 78284 (NAS 8-32584)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0045, THE LATITUDINAL DISTRIBUTION OF IONOSPHERIC ABSORPTION
H.J. CHIVERS, Utah Higher Education System, Graduate School, *Logan, Utah* 84321 (ATM76-17762)

This grant will support a program of analysis of the data from the latitudinal chain of riometers to be operated in Alaska during the period of the International Magnetospheric Study (IMS). This network of stations already exists in a primitive form and is about to be expanded to higher latitudes with improved instrumentation so that high-quality digital records will be obtained. Since the new riometers which will be used will have a fast response time, emphasis will be placed on the analysis of the fine structure of auroral absorption events. Recent studies of absorption events recorded with the Alaskan chain have shown that there are probably two significant components to each absorption event. These components tend to move at different velocities in the latitudinal direction, and, in fact, the components have been observed to move in opposite directions. These movements can be related to corresponding movements in the magnetosphere following solar disturbances and the movements have been used to derive a value for the electric field of the magnetosphere. The main result expected will be to show to what extent the short period variations of absorption take part in the complex latitudinal motion of absorption. In addition, a class of fast isolated events associated with relativistic electron precipitation has been identified, and these can be used in conjunction with observations using the Chatanika radar facility to investigate magnetosphere dynamics. This award represents a small but important part of the coordinated activities to be performed under the IMS.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0046, STRATOSPHERIC PROCESSES
L.R. MEGILL, Utah Higher Education System, Center for Res. in Aeronomy, *Logan, Utah* 84321 (ATM77-01869)

This grant funds the improvement of an existing computer code for atmospheric chemistry calculations and the application of the improved computer code to two specific problems. The major improvement to be made involves the addition to the code of precalculated values of photodissociation rates (as functions of altitude and solar zenith angle) for a variety of minor species. This will allow the code to be used for the study of two unexplained phenomena of particular interest; the behavior of ozone at sunrise and the twilight behavior of minor species. This will result in a more useful computer code for general atmospheric chemistry research and an improved understanding of the behavior of minor species in the Earth's atmosphere.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0047, UTILIZATION OF INFRARED SCANNING DEVICES FOR CENSUSING BIG GAME ANIMALS
J. SPILLETT, Utah Higher Education System, Agric. Experiment Station, *Logan, Utah* 84321 (0069333; UTA01002)

OBJECTIVE: Develop a more sensitive census technique for determining the numbers of large herbivores using Utah's forests and rangelands. Large numbers of elk and mule deer spend their summers in the high-elevation forests of Utah and winter in the scrub woodlands and foothills. This project will attempt to use infrared scanning devices to determine the seasonal numbers in each type.

SUPPORTED BY Utah State Government

5.0048, PROGRAM FOR ANTARCTIC MAPPING OPERATIONS
R.H. LYDDAN, U.S. Dept. of The Interior, Geological Survey, *Herndon, Virginia* 22092 (DPP77-17777)

This interagency agreement continues support of the U.S. mapping operations in Antarctica. The geodetic, cartographic and support activities of the U.S. Geological Survey include field control for mapping and for science projects. Support for international responsibilities of the U.S. under the Scientific Committee on Antarctic Research will be provided by exchange of carto-

graphic materials with other countries and the preparation and maintenance of photographic and map files and indexes. The computation and adjustment of previously established control and the printing of aerial photography for mapping and for reference purposes will also be carried out. Specific field activities during the 1977-78 field season include accurate location of research sites on the Ross Ice Shelf by means of satellite observation, ground control in the Orville Coast area, and geodetic control, with aircraft transportation and geoceivers in the lower Antarctic Peninsula. The control work in the lower Antarctic Peninsula area will be done in cooperation with the British Antarctic Survey.

Nine USGS cartographic engineers will carry out field work in Antarctica during the 1977-78 field season. These are: two on the Ross Ice Shelf Project; three on Lassiter Coast mapping project; two on the joint USGS/BAS mapping project on lower Antarctic Peninsula; and two on satellite observations program at South Pole Station.

Previous award number is DPP-76-00197 A01 (proposal No. DDP-76-23088).

SUPPORTED BY U.S. National Science Foundation, Div. of Polar Programs

5.0049, REMOTE SENSING OF PORPHYRY COPPER ALTERATION ZONES

R.G. SCHMIDT, U.S. Dept. of The Interior, Geological Survey, *Herndon, Virginia* 22092 (9360-01942)

STATES TO WHICH PROJECT PERTAINS: Arizona.

The project will develop and test techniques of remote sensing of large sulfide deposits, especially prophyry copper-type deposits, by digital processing of LANDSAT data. Attempts will be made to relate rock alteration zones, soil minerals, and reflectance characteristics as measured from near-surface with reflectances obtained by scanners in satellites. Methods devised will be tested by using them as evaluation tools in suitable incompletely explored areas that are regarded as favorable for the occurrence of porphyry copper deposits.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0050, REMOTE SENSING WITH GROUND-PROBING RADAR

L.A. RUBIN, E N S C O Incorporated, *Springfield, Virginia* 22151 (APR76-03300 A02)

In Phase I, it was demonstrated that, with electromagnetic ground-probing radar, geologic structures of interest to subsurface planners will return detectable signals at ranges greater than 25 feet. It was also shown that it is possible to enhance the interpretation of the information in the raw signals through computer signal processing.

Phase II (the present grant) consists of five tasks: (1) project planning and reduction of previously acquired data; (2) multiple borehole radar testing at Trap Rock Quarry Site near Chantilly, Virginia; (3) multiple borehole radar testing at Metro system; (4) in-depth signal analysis and development of three-dimensional displays for use by design engineers; and (5) multiple borehole radar development. Dissemination of results will partially be accomplished at two meetings with a technical evaluation group made up of distinguished representatives from all phases of subsurface site investigation. The research addresses the need for economical and technically improved real-time predictive techniques for the investigation, interpretation, and definition of geological conditions prior to subsurface excavation projects. It is anticipated that this effort will ultimately result in a new family of tools for subsurface investigation. This is a supplement to APR76-03300.

SUPPORTED BY U.S. National Science Foundation, Div. of Advanced Productivity Research & Technology

5.0051, AURORAL X-RAY IMAGING

G.K. PARKS, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (ATM77-09080)

This grant continues auroral X-ray research with the new X-ray imaging detector system that was developed under a previous National Science Foundation Grant, ATM-7402762 A02. A unit was built and test-flown from Fairbanks, Alaska, on September 23, 1976. The data indicate that the system operated well during the flight duration of about 6 hours. This X-ray image detector system has the capabilities of obtaining data with 1 km spatial resolution at electron stopping heights (at 100 km altitude); and for moderately intense X-ray events, motions as fast as 100 km/sec will be recognized in the data. This ability to obtain high-resolution X-ray data will enable a more detailed study of electron precipitation mechanisms to be undertaken.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0052, RESEARCH IN ANTARCTIC METEOROLOGY

W. SCHWERDTFEGER, Univ. of Wisconsin, School of Letters & Science, *Madison, Wisconsin* 53706 (DPP77-04506)

This project involves research into four aspects of the synoptic meteorology of Antarctica, using historical data, present-day U.S. and foreign synoptic observation, and satellite measurements. The research will focus initially on the tropospheric moisture transport into East Antarctica and on the atmospheric driving forces of the Weddell Sea gyre, then continuing into an investigation of strong terrain-induced surface winds and cold-air jets in the atmospheric boundary layer. No logistics support required.

SUPPORTED BY U.S. National Science Foundation, Div. of Polar Programs

5.0053, REMOTELY MONITOR PRECIPITATION BY ANALYZING DATA FROM NIMBUS SCANNING MICROWAVE RADIOMETERS

J.A. WEINMAN, Univ. of Wisconsin, School of Letters & Science, *Madison, Wisconsin* 53706 (NAS 5-24230)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0054, MEASUREMENTS OF THE NATURAL BACKGROUND OF CONDENSATION NUCLEI AT HIGH ALTITUDE FOR ASSESSMENT OF FUTURE SPACE SHUTTLE EFFLUENT EFFECT

D.J. HOFMANN, Univ. of Wyoming, School of Arts & Sciences, *Laramie, Wyoming* 82071 (NSG 7349)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, SATURATED HEATED OXYGEN/BLEED AIR NEBULIZER FOR RESUSCITATION OF THERMAL CASUALTIES IN AIR EVACUATION

F.S. PETTYJOHN, U.S. Army, Aviation Medicine Res. Div., *Ozark, Alabama* 36360 (DA0B6902)

To develop and test the concept of use of heated, saturated oxygen/bleed air in helicopter air evacuation/resuscitation of the hypothermic or pulmonary casualty.

Develop new technology and equipment to use helicopter bleed air and electrical power 28 vdc or 115v400Hz to provide a source of heated, dry or supersaturated oxygen or air to deliver heat to the hypothermic combat casualty. The concept of the lungs as a heat exchanger employing the extremely large surface area available for the passage of blood as a distributer of heat to distal organs represents a unique application in air evacuation and resuscitation. The equipment will be designed for simplicity, low cost, and compatibility with UH-1 and UTTAS aeromedical helicopters. Compatibility with advanced oxygen systems

(chlorate candle and Army molecular sieve oxygen generators) will be explored. Concept and prototype evaluation will be conducted using mongrel dogs as subjects. Monitoring of temperature and pulmonary effects of increased inspiratory air/oxygen during simulated and in-flight air evacuation missions will be accomplished.

ADDENDA: Supporting agency address is: MDRDC Aeromedical Research Lab, PO Box 577, Ft Rucker, AL 36362

SUPPORTED BY U.S. Dept. of Defense, Army

6.0002, KC-135 WST VISUAL SYSTEM EVALUATION

J.A. THORPE, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF223460)

To compare the training effectiveness of the three types of flight simulator visual systems (day/night color computer-generated image (CGI), night only/point light source CGI, and TV-model board) for use in KC-135 Combat Crew Training School (CCTS). The results of this comparison will impact the decision to procure a visual system for three CCTS simulators. This investigation will (1) study in depth the role of a visual system for tanker-transport-bomber (TTB) flight simulators, (2) determine instructional strategies best suited for such a device, and (3) develop innovative techniques to maximize training in the CCTS.

Three groups of ten KC-135 student copilots from CCTS will receive specialized training in simulators equipped with one of the three visual systems of interest. Following simulator training, each copilot will fly the aircraft and transfer of training will be assessed. Student copilots will be used instead of pilots upgrading to the aircraft commander crew position since it is expected that the less experienced student copilot will show the most learning during simulator training. The task to be trained will be the visual flight rules (VFR) traffic pattern because it is the most visually dependent task flown in the KC-135. Therefore, it is the task which exercises the visual system to the greatest degree. The utility of a side window as well as a forward window will be assessed by training all students to fly left-hand traffic patterns from the left seat. This restriction for left-seat training exists because of hardware availability--the TV-model board system, as it is currently configured, can only display a side field of view from the left seat. Therefore, all three simulators will be configured for left window-left seat student training for standardization.

ADDENDA: Supporting agency address is: AF Human Resources Laboratory FTR, Williams AFB, Arizona 85224

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0003, NEUROPHARMACOLOGICAL EVALUATION OF TOXIC CHEMICALS

M.B. STERMAN, Univ. of California, School of Medicine, *Los Angeles, California* 90024 (DF319630; F33615-76-C-5014)

The 6570 AMRL has been investigating the pharmacological and toxicological effects of certain missile propellants in order to more safely use such compounds in a manner dictated by good industrial hygiene and industrial medical practice. In order to set standards for exposure criteria and to determine methods for combating the effects of those propellants and chemicals in exposed individuals, it is necessary to determine the exact mode of action of the agents on specific body function. The specific objective is to study the effects of hazardous chemicals of interest to the USAF on behavior responses in laboratory animals, obtain data on performance, correlate behavior changes with other neurological events, and test the efficacy of therapeutic measures to abort untoward effects of the agents.

A study will be conducted to advance the state-of-the-art with respect to the central nervous system effects of toxic chemical compounds of interest to the USAF. Previous studies in this regard have been performed using the cat as the primary model. Research with the cat has indicated a need to change the primary model to a primate for comparative purposes. It is now evident that certain forms of chemically induced epileptic manifestations are better studied in the primate. The specific agent to be studied using primate models will be the propellant, methylhydrazine. The data will be utilized to study mechanisms of action of the compound as well as various therapeutic regimens necessary to abort toxic manifestations. The data will also help develop toxicity criteria for the USAF as required by AFR 19-1.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab TH, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0004, HEAT RESISTANCE OF MICROORGANISMS

J.E. CAMPBELL, U.S. Dept. of Hlth. Ed. & Wel., P.H.S. Food & Drug Admin., *Washington, District of Columbia* 20204 (04068)

OBJECTIVES: (a) Provide technical support and advice to the Chief, Planetary Quarantine Program, on the efficacy of sterilization cycles and the expected microbiological loading on spacecraft components and (b) to conduct research on the mechanism of thermal inactivation of bacterial spores and investigate ways and means of improving the effectiveness of sterilization cycles.

JUSTIFICATION: Although this work is funded through an agreement with NASA, the information derived is of direct interest to FDA. Fundamental knowledge on the mechanism of thermal inactivation of microorganisms is essential to critical evaluation of thermal processes for foods and in anticipating (and correcting) problems which may arise in new processing techniques.

DESCRIPTION OF WORK: During FY 1977, advisory and support services will be provided to the Chief, Planetary Biology and Quarantine Program, as necessary including membership on panel 5D of COSPAR. Experimental exploration of several hypotheses of thermal resistance will be continued in connection with the development of an in vitro test of thermal inactivation of bacterial spores. A supply source of 'pure' spore crops of different heat resistance will be produced for that of other interested investigators. The experimental sterilization facility will be built and tests undertaken to optimize environmental conditions for use.

SUPPORTED BY U.S. Dept. of Health Education & Welfare, Food & Drug Admin., Bureau of Foods

6.0005, HUMAN OPERATOR CONTROL STRATEGY MODEL

J.L. BIRCHFIELD, Georgia Inst. of Technology, Graduate School, *Atlanta, Georgia* 30332 (DF228160; F33615-77-C-0042)

To develop a model of human operator control strategy on perceptual/motor tasks such as those involved in flying. The work will also include a preliminary investigation of how control strategy is related to cue sampling and interpretation, learning, and changes in task variables such as performance criteria and task difficulty. Planned use of the model will be in performing measurement applications for simulation, training, and transfer of training research.

The approach is to conduct a survey and develop a summary of human performance characteristics that should be considered in developing a control strategy model. Then, based on that data, a theory of control strategy development and learning will be formalized, precise operational definitions of control strategy applicable to the tasks of interest set forth, and a model formulated. Preliminary tests of the model will be performed to demonstrate its validity, detect problem areas, and investigate basic relationships between control strategy and learning, cue sampling and utilization, and task variables. The manual control task used for the preliminary tests will be implemented on the simulation and training advanced research system for use by the Air Force in more extensive testing and continued modeling studies.

ADDENDA: Supporting agency address is: AF Human Resources Laboratory ASM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0006, PRELIMINARY CHARACTERIZATION OF PERSISTING CIRCADIAN RHYTHMS DURING SPACE FLIGHT - NEUROSPORA AS A MODEL SYSTEM

F.M. SULZMAN, Harvard University, School of Medicine, *Cambridge, Massachusetts* 02138 (NAS 9-15326)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0007, INVESTIGATION OF SIGNAL ANALYSIS TECHNIQUES FOR ECG/VCG CLASSIFICATION
M.E. WOMBLE, Scientific Systems Inc., *Cambridge, Massachusetts* 02138 (DF320400; F33615-77-C-0606)

Over the past four years, computer algorithms have been developed for digitizing and preprocessing vectorcardiograms (VCG), compressing the data so that it can be efficiently transmitted via commercial grade telephone lines, and classifying VCGs into normal and a selected set of abnormal categories. In addition, computer algorithms have been developed for detecting and identifying various categories of arrhythmias. These algorithms have been assembled into a prototype version of an overall VCG interpretation system which is operational on the USAF San Antonio Data Services Center (USAFSADSC) IBM 360-65 computer. The objective of this effort is to extend the currently utilized algorithms and to develop new algorithms for interpretation of VCGs based on experience gained with the operational prototype VCG interpretation system. This is an extension of the work done under 77550112.

Algorithms developed for detecting and classifying arrhythmias via R-R intervals will be extended to include P-R intervals. KL expansions will be performed separately on the P and QRST segments of VCGs. Investigations of the tendency of VCG pattern vectors to cluster in feature space will continue. Computer algorithms will be developed for calculating the eigenvalues and eigenvectors of large matrices.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine NG, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0008, DEFINITION OF SPACELAB I EXPERIMENT FOR ADAPTATION OF VESTIBULO-SPINAL REFLEX MECHANISMS DURING SPACE FLIGHT
D.J. ANDERSON, Univ. of Michigan, School of Medicine, *Ann Arbor, Michigan* 48104 (NAS 9-15375)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0009, LYMPHOCYTE MICROELECTROPHORESIS
A.L. RUBIN, Cornell University, School of Medicine, *New York, New York* 10021 (NAS 9-15378)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0010, WINDSCREEN ANALYSES
B.D. TARGOVE, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321130)

To provide a technical document which analytically defines and treats the current Air Force visual effects of windscreen problems. An optical analysis will classify, define and describe optical characteristics, and will suggest new optical measures, test criteria, and visual variables for lab investigation. A visual performance analysis will treat criteria operational tasks analytically to determine the relationships to visual and optical factors and measures. A visual quality inspection analysis will be made to categorize and quantify optical defects found in visual inspection processes.

Optical analysis - optical characteristics and specification techniques will be catalogued, defined and analyzed in terms of measurement procedures, equipment, measurement interrelationships and geometric effects. Visual performance analysis - critical mission segments will be determined and criterion tasks selected which relate to optical variables, visual cues will be related to these tasks and to suggested laboratory visual measures, the relationship between operational tasks and various optical areas of the windscreens requiring differential optical specification will be determined. Visual quality inspection quantification - the optical defect categories and lexicon used in visual inspection will be captured and quantified.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0011, VARIABLE IDENTIFICATION
G.J. VALENTINO, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF322460)

Establish a data base on the soviet ZSU-23-4 antiaircraft artillery (AAA) weapon system. Data for simulation is needed on, but not limited to, the radar, gun, and fire control computer dynamics, system configuration, modes of operation, and crew training procedures.

Intelligence data will be acquired through such agencies as AFSC/FTD, TAC/ADTC, USAF/SA, and US Army/Foreign Science and Technology Center, and others.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab EM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0012, EVALUATION OF SURFACE PROPERTIES IN SPAR ELECTROPHORESIS
J.W. VANDERHOFF, Lehigh University, School of Arts & Sciences, *Bethlehem, Pennsylvania* 18015 (NAS 8-32657)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0013, BIOCHEMICAL ADAPTATION OF ANTIGRAVITY MUSCLE FIBERS TO DISUSE ATROPHY
F. BOOTH, Univ. of Texas, School of Medicine, *Houston, Texas* 77025 (NAS 9-15388)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0014, TRACE METALS CORRELATIONS
E.L. ARNOLD, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF321760)

The objective of this effort is to develop methods of trace metal analysis applicable to biological specimens, to apply trace metal analysis techniques on a routine basis to patients seen by the Aeromedical Consultation Service, to ascertain the association of changes in trace metal content in biological specimens with the presence or absence of cardiovascular and metabolic diseases, and to ascertain the usefulness of trace metal analyses as a predictive and diagnostic tool for the detection and/or prevention of cardiovascular and metabolic disease in the Air Force flying population.

Instrumentation will be gas and/or liquid chromatography and atomic absorption spectroscopy. Accuracy of all analytical methods must be verified by recovery studies and NBS standards, and the results checked by a separate, completely independent method. Precision must be at least 1/4 the normal range. All methods developed for trace metal analysis will document any sources of contaminating trace metals from the environment. Stability of samples analyzed will be documented across time. The chemical and instrumental interferences caused by competing elements must be documented. Chromium in biological fluids will be measured first. A simple method using atomic absorption spectroscopy will be developed, as well as a chromium method using gas chromatography techniques. Work was formerly documented under 7755-05-08.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine NG, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0015, ACQUISITION AND ANALYSIS OF AUDIOMETRIC AND VESTIBULAR DATA FOR EVALUATING AND MONITORING IMPAIRMENT IN FLYERS & GROUND PERSONNEL
F.A. BROGAN, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF315720)

To provide engineering expertise in acoustics, circuitry and servo-mechanisms for the evaluation of aircrewmen referred for aeromedical evaluation and the acquisition of physiological data for development of function tests with predictive value. A corolla-

ry aim is the more effective utilization of equipment through design and fabrication of interface devices.

Independent research and development will be conducted in the various areas of electronics, such as analog circuitry and techniques, digital integrated circuit components and interface equipment, solid-state circuits and various types of equipment for data analysis. Development of techniques for solving specific problems in data acquisition (Physiology and Behavior, 8-1972, pp 557-560) and clinical techniques (SAM-TR-72-9) will be pursued. Specific technical guidance will be provided in the planning of other Branch projects, conduct of the research, analysis of data and preparation of reports.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine NG, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0016, AEROMEDICAL EVACUATION EQUIPMENT

M. CHANDLER, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322090)

To test and evaluate newly developed (commercial or in-house) items of medical material to determine their effectiveness in aeromedical evacuation. The Biomedical Systems Branch has an ongoing program of evaluating medical material items to satisfy identified operational requirements for aeromedical evacuation. Performance criteria have been established to insure that medical equipment items meet stated operational requirements. Current state-of-the-art of medical material technology will be continually assessed.

The test program normally consists of six major areas, patient-user safety, operational specifications, environmental effects, electrical and mechanical characteristics, and human factors. Each area is subdivided into specific engineering tests or evaluations. When the test program is completed, the results are compiled and a report is sent to the field. The information is kept on file and updated or modified as user test reports are received. This is a continuation of part of the work formerly documented under work unit 7755-15-02.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine NG, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0017, CHARACTERIZATION OF HYDROCARBON EMISSIONS FROM AF TURBINE ENGINES

J.P. CONKLE, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF320850)

The efforts will provide baseline data for assessing the biomedical impact of Air Force aircraft operations, prior to the advent of regulatory restrictions. The information is required not only for assessing environmental impact but also for evaluating combustor design criteria, smoke suppression additives and engine operational cycles. The work is closely coupled and coordinated with ongoing turbine engine emissions measurement at the AFWL and AFAPL.

Chemical characterization of the organic compounds present in turbine engine exhaust will be accomplished for both gaseous and particulate species. Samples will be obtained from a variety of sources including AF and Navy operational engine test stands and the AFAPL single-combustor test rig. Analysis will be performed by a coupled gas chromatograph-mass spectrometer data system. Results will be screened by AMRL/TH for toxic hazard assessment. Prior progress in this effort has been documented under work unit 7164-16-13. This new work unit implements new technology planning objective alignment as directed by HQ Aerospace Medical Division.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0018, FEASIBILITY EVALUATION OF CURRENT ON-BOARD OXYGEN DELIVERY SYSTEMS (OLOGS)

L.J. LUSKUS, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322240)

To test for human compatibility current on-board oxygen generating systems as they become available. The test will include a fluomine-based OLOGS, the GE electrochemical device and the Bendix and Garret molecular sieve systems.

Flight prototype systems will be tested for contaminant off-gassing and human physiologic compatibility under simulated flight profiles.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0019, STANDARDS FOR PERIODS OF EXCUSAL BETWEEN CHAMBER TRAINING & AIRCRAFT FLIGHTS

R.M. OLSON, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF323230)

Air Force missions regularly expose aircrew members to cabin altitude as high as 25,000 feet for periods up to an hour. Consequently, decompression sickness is a potential hazard. Regulations require that aircrews periodically take refresher courses including altitude chamber training. The air force surgeon general has raised the question as to the optimal grounding time between altitude chamber training and routine aircraft flights. On the one hand, excessive grounding times or periods of excusal are wasteful of manpower; on the other hand, too brief periods of excusal will increase the potential for decompression sickness. Recent advances in Doppler technology provide a new approach to determine incipient bends. The object of this effort is to use this new technology to determine the optimal periods of excusal between training and prolonged altitude exposures.

The effect of routine altitude-chamber training flights on the probability of developing bends in subsequent prolonged altitude exposures will be determined by use of the Doppler ultrasonic bubble detector. This newly developed device estimates the level of circulating bubbles which in turn estimates the probability that bends will occur. The shortest grounding time between training and mission flights which does not increase the likelihood of bends will be determined.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0020, TEST AND EVALUATION OF A MOLECULAR SIEVE OXYGEN GENERATOR

R.L. STORK, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322940)

Considerable amounts of support and maintenance are required by the use of liquid oxygen (LOX) as the oxygen source on-board aircraft. The high altitudes at which USAF aircraft operate necessitate an aircraft oxygen supply that can be used to supplement the aircrew's breathing mixture for the duration of the flight. The current method uses a LOX supply, LOX converter, oxygen manifolds and regulator(s). Correspondingly, ground support is frequently required and periodic maintenance is inevitable. Great advantages, including manpower savings, increased system safety, and improved bare base operational capability, will be gained by providing an on-board means of in-flight oxygen generation. A variety of methods for in-flight oxygen generation have been proposed; of these, molecular absorption is the most attractive. The objective of this work unit is to explore the environmental and engineering variables which affect the performance of a molecular sieve oxygen generator, thus providing a technology base from which the performance of the MSOG can be optimized. These variables include, but are not limited to, absorbent material, absorbent bed physical dimensions, absorbent bed cycle time, inlet pressure and temperature, and outlet flow demand.

A MSOG is being obtained from NADC. Once received, environmental testing will be conducted. A matrix of test conditions including altitude, outlet flow rates and inlet pressures (40, 60, 80, 100 and 120 psia) will be explored. During these tests nitrogen, oxygen and argon levels will be continuously monitored. Flow rates and pressure drops through the system will be measured. These evaluations are essential prior to designing and interfacing new oxygen regulators and oxygen delivery components.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0021, TONE COUNT AUDIOMETRIC COMPUTER (TCAC) - COMPARISON WITH CONVENTIONAL AUDIOMETER

H.C. SUTHERLAND, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF321640)

The Air Force utilizes pure tone audiometry results extensively in physical standards testing and in monitoring the hearing of noise-exposed personnel. These auditory tests need to be as accurate and reliable as possible. This effort is to compare pure tone audiometry using the tone count audiometric computer (TCAC) with that produced using a conventional manual audiometer.

Pure tone threshold audiometry will be performed on a number of normal and hearing-impaired subjects. They will be tested with both the TCAC and a conventional manual audiometer. The two methods will be compared in terms of absolute agreement and reliability. Other factors of interest are the skill and training required for operators of the TCAC and the general reaction of subjects to this device. This effort was formerly documented under 7755-08-01.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine NG, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0022, SIGNIFICANCE OF ARTERIOGRAPHIC MINIMAL CORONARY ATHEROSCLEROTIC HEART DISEASE IN THE AIRCREW MEMBER

J.H. TRIEBWASSER, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF321920)

OBJECTIVES: Minimize the number of flyers who must be grounded because of the presence of minimal coronary artery disease that is functionally insignificant, establish techniques to detect disease progression/regression, evaluate the effect of risk factor modification on the progression of the disease, and establish the significance of given lesions on long-term prognosis for the purpose of establishing retention criteria.

Aircrew members identified as having minimal coronary atherosclerotic heart disease (i.e., a degree of obstruction associated with a coronary event rate that is no greater than that observed in an apparently healthy, similarly aged population not subjected to cardiac catheterization) will be followed longitudinally with serial risk factor assessment, noninvasive tests (e.g., exercise stress testing) and coronary arteriography to establish significance of given lesions and the influence of risk factor modification on disease progression. Newer noninvasive techniques used to assess the functional capacity of the coronary circulation will be correlated with the results of cardiac catheterization in an attempt to reduce the frequency of the latter procedure at no expense to flying safety and mission completion.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine NG, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, ELDOR INVESTIGATIONS OF RADIATION PROCESSES

L.D. KISPERT, Univ. of Alabama, School of Arts & Sciences, *University, Alabama* 35486 (E(40-1)-4062)

The objective of the present research is to examine the role of the host matrix as a function of temperature in determining the type and yield of radicals produced by x-irradiation of a crystalline or glass material using electron-electron double resonance (ELDOR), electron-nuclear double resonance (ENDOR), electron spin resonance (ESR) and heavy atom substitution techniques. After many years of research on the effects of radiation on crystalline materials, it is still difficult to predict from the thermal history, nature of radiation, crystal structure or form of the parent molecule what radical species will be stable at any given temperature. However, an examination of the ELDOR spectra of an irradiated substance results in a partial or complete measure of the relaxation mechanisms which, in turn, are related to the host matrix itself. The host matrix can be changed slightly by using the heavy atom substitution technique allowing a study of the relation among host matrix variation, radical yield and relaxation parameters.

RESULTS TO DATE: ESR investigations carried out on single crystals of irradiated fluoro, chloro and bromo derivatives of acetamide and acetic acid have shown that a large matrix effect is present which is dependent upon the leaving group size, crystal structure and degree of crystallization. ELDOR measurements between 5 degrees K and 370 degrees K have shown a large variation in ELDOR intensity dependent on intramolecular motion, quadruple coupling, p-orbital anisotropy, spin diffusion and tunnelling rotation. Forbidden ESR lines overlapped by intense ESR lines, ESR lines too broad to detect and radical clusters were studied by ELDOR.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Physical Research

8.0002, EXPERIMENTS IN LOW-TEMPERATURE PHYSICS

W.H. PARKER, Univ. of California, School of Physical Sciences, *Irvine, California* 92664 (DMR76-23566)

This research continues work carried out under NSF grant DMR74-20310 and includes several experiments in low-temperature physics investigating properties of both super-conducting and normal metals. The investigation of nonequilibrium effects in superconductors exposed to optical radiation will be continued using tunnel junctions as a probe of the superconductor. The experiments will concentrate on attempts to determine the excess quasiparticle distribution function as a means to distinguish between several microscopic models of nonequilibrium superconductors. A second set of experiments will investigate the temperature dependence of the surface impedance of normal metals in the extreme anomalous limit. The temperature dependence of the electron scattering rate extracted from these measurements provides information different from, but complementary to, that based on the temperature-dependent electron scattering rate obtained from dc conductivity measurements. Measurements will be made on copper, aluminum, and potassium. The effect of impurities near the surface and an applied magnetic field will be investigated. Primary emphasis in this work is on the non-equilibrium effects in superconductors. The anomalous skin effect studies now underway will be completed but not expanded.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0003, A STUDY OF PLASMA HEATING BY INTENSE RELATIVISTIC ELECTRON BEAMS

N. ROSTOKER, Univ. of California, School of Physical Sciences, *Irvine, California* 92664 (EY-76-S-03-0034, 0207)

The program involves the coupling of intense particle beams with plasma. For several years the theory of interaction of a rotating relativistic electron beam has been developed and comparisons have been made with a considerable amount of experimental data obtained in the last six months. Improvements required in the experiment are now clear in order to attain the objectives which include complete transfer of beam energy to plasma, thermalization of the plasma, and the creation of stable plasma configurations with field reversal. The experiment does not involve new technology, but involves a detailed scientific study with a broad range of diagnostics. During the past year intense ion beams of H cation and H anion have been developed. Further development of this new technology is planned with emphasis on increased beam current and beam transport so that these beams can be used in future fusion-plasma experiments.

RESULTS: Plasma heating and strong field reversal have been demonstrated for a rotating E-beam interacting with a plasma of density 10 to the 13th power - 10 to the 14th power cm to the minus 3rd power. H cation beams of about 300 amperes and H anion beams of 1 ampere have been produced for 1 microsecond at voltages of 500 to 900 kilovolts. A small

Tokamak has been constructed in order to study auxiliary heating with particle beams. The Tokamak has been operated at 4 kilogauss with a confinement time of about 5 milliseconds.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Magnetic Fusion Energy

8.0004, COLLECTIVE ACCELERATORS
N. ROSTOKER, Univ. of California, School of Physical Sciences, *Irvine, California* 92664 (PHY76-12856 A01)

Work will be carried out on ion accleration by intense electron beams. This will include electron ring acceleration linear beams and toroidal devices. Work on acceleration in the presence of strong external magnetic field will be pursued. Work will continue on a pulsed H ion diode.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0005, MULTIPARTICLE SPECTROSCOPY EXPERIMENTS
P.E. SCHLEIN, Univ. of California, School of Letters & Science, *Los Angeles, California* 90024 (PHY77-20762)

A three-part program to study the properties of strong interactions at very high energies will be conducted: (1) Continued analysis of stages of matter produced in pp collisions at the CERN interacting storage rings. Particular emphasis will be given to analyzing data accumulated at individual proton beam energies of 25,26 GeV and 31,31 GeV. Diffractive phenomena, inclusive delta production and rho, K* and Phi production will be analyzed. (2) Continued analysis of the production of hydronic jets produced in high-energy collisions at Fermilab. Particular emphasis will be given to the production of hydronic jets produced with high transverse momentum. The experiment is likely to yield information relevant to the constituent structure of the proton. (3) A test will be conducted at Fermilab to study the feasibility of performing experiments on the detailed structure of jets at the highest assessible energies and momentum transfers.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0006, GRADIENT FREEZE GROWTH OF INP
W.P. ALLRED, Crystal Specialties Inc., *Monrovia, California* 91016 (DF903010; F19628-77-C-0105)

AF function - signal processing and integrated optics for communications systems. Deficiency/opportunity - indium phosphide crystals for use as substrates for integrated optics and signal processing devices are of dubious quality, in short supply and very costly. Objective - to develop a growth system for and to grow high-quality, low-cost, single crystals of indium phosphide. How research contributes - single-crystal indium phosphide is an extremely promising material for use as substrates for integrated optics, signal processing, and microwave devices. One of the major deterrents to the development of such devices is the limited availability and very high cost of high-quality substrate material. Successful completion of the effort outlined in this contractual effort should eliminate these deficiencies.

A high-pressure gradient-freeze crystal growth system will be fabricated. The influence of synthesis, growth and material parameters on the growth and perfection of grown crystals will be investigated. N-type, p-type, undoped, and semi-insulating single crystals of indium phosphide will be grown.

ADDENDA: Supporting agency address is: Rome Air Development Center ETS, Griffiss AFB, N Y 13440

SUPPORTED BY U.S. Dept. of Defense, Air Force

8.0007, SUPERCONDUCTING BEARINGS FOR APPLICATION IN CRYOGENIC EXPERIMENTS IN SPACE
C.W. EVERITT, Stanford University, W.W. Hansen Lab. of Physics, *Palo Alto, California* 94305 (NAS 8-32605)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0008, HIGH-ENERGY PHYSICS
A. KERNAN, Univ. of California, School of Natural & Agric. Sc., *Riverside, California* 92502 (EY-76-S-03-0034)

In the coming year we shall be recording proton-proton interactions at center-of-mass energies up to 62 GeV with the Lampshade Magnet Detector at the CERN Intersecting Storage Rings. We shall focus on quark-quark interactions and the properties of quark jets. We shall also look for evidence of charmed particle production in strong interactions.

At the LBL Bevalac we shall be continuing our streamer chamber study of relativistic heavy ion interactions. The emphasis here will be on central collisions which may give evidence for predicted collective effects including nuclear shock waves and the creation of new forms of nuclear matter.

An increasing effort will be devoted to construction of the Time Projection Chamber Facility for the PEP electron-positron storage rings project. This is a joint venture with groups at LBL, UCLA, Yale and Johns Hopkins.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of High Energy & Nuclear Physics

8.0009, EXCITED-STATE CROSS SECTIONS IN CARBON MONOXIDE
R. POE, Univ. of California, School of Physical Sciences, *Riverside, California* 92502 (DF461220; F33615-77-C-2011)

Obtain theoretical values for electron impact cross sections in carbon monoxide. Cross sections will include momentum transfer, rotational, and vibrational excitation for ground and excited vibrational-rotational states.

Semi-classical and quantum methods will be employed in numerical solutions of inelastic scattering of electrons from molecules with permanent dipole moments.

ADDENDA: Supporting agency address is: AF Aero-propulsion Laboratory POD, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

8.0010, STATISTICAL PHYSICS
S. MA, Univ. of California, Graduate School, *San Diego, California* 92037 (DMR77-04679)

This research is a continuation of that supported by DMR 76-08443.

Research in several topics of theoretical statistical mechanics will be carried out. (1) Monte Carlo techniques will be applied to renormalization group calculations. (2) The theory of non-linear interactions and solitons will be studied with the aim of understanding general relaxation mechanisms. (3) The calculation of high-order perturbation terms of statistical mechanical models such as the Ginzburg-Landau model will be carried out.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0011, VORTEX NUCLEATION, SURFACE BARRIERS AND VORTEX PINNING IN TYPE II SUPERCONDUCTORS
B. ROSENBLUM, Univ. of California, Graduate School, *Santa Cruz, California* 95060 (DMR74-20008 A01)

The research program initiated under NSF grant 0DMR74-20008 will be completed. Microwave surface impedance measurements will be used to study the properties of type II superconductors. The primary purpose of the experiments is to understand vortex nucleation at the surface of a superconductor and a major part of the work will be a study of the initial entry of magnetic flux into the interior of a superconductor. Studies of the surface free energy barrier, vortex pinning, and surface superconductivity will be made. Most of the experimental work will be done for Nb3Sn but related compounds also will be studied as time and resources permit. A long-term goal of the work is to understand the various mechanisms which are important in the absorption of energy from a microwave field.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0012, THE INTERACTION OF LIGHT WITH ATOMS
J. COOPER, Univ. of Colorado, School of Arts & Sciences, *Boulder, Colorado* 80302 (INT77-04191)

There is considerable interest at the present time in the scattering of high-power laser radiation from atoms. Even at low laser fields, when collisions can occur, resonance fluorescence as well as Rayleigh scattering results. At high laser fields, more complicated Raman-type effects are possible.

This award provides partial support to enable the principal investigator to spend eight months at the Physics Department of the University of Otago in New Zealand where he will work with J.N. Dodd on various aspects of the interaction of light with atoms. They plan to carry out theoretical work on the redistribution of resonance radiation in the presence of collisions, with particular attention to m-degeneracy effects in high laser fields and to the non-impact regime of the profile. In addition, they will conduct an experimental program which will include an investigation of the coherent sharing of excitation that occurs between an excited atom and its perturber.

SUPPORTED BY U.S. National Science Foundation, Div. of International Programs

8.0013, STUDY OF THE D.C. AND A.C. FLICKER NOISE
C.K. IDDINGS, Univ. of Colorado, School of Arts & Sciences, *Boulder, Colorado* 80302 (ENG76-04289)

This program will be concerned with the development of a versatile and sensitive computer-based system for measurement of flicker (1/f) noise using D.C. and A.C. signals. A novel feature of the system will be the capability of detection of both amplitude and phase fluctuations in the A.C. method. The measurement capability will also include correlation effects, magnetic effects, and low-temperature effects. Initial studies will concentrate on the phenomenology of the A.C. flicker effects in carbon resistors and p-n junction devices. The major focus of the program will be on measurements of bulk flicker noise in homogeneous semi-conductor and semi-metal specimens using multiple probe contacts. Careful attention will be given to the determination of related physical properties such as Hall effect noise and nonlinear characteristics. The interesting phenomenon of flicker noise produced by thermal agitation of electrical charge in certain loss dielectrics will also be studied.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

8.0014, ISOTOPE SEPARATION IN PLASMAS
J.L. HIRSHFIELD, Yale University, School of Engineering, *New Haven, Connecticut* 06520 (ENG76-22430)

An experimental study of multi-ion resonances in a plasma will be initiated with a view towards isotope separation. The effort will attempt to combine the considerable accumulated experience on rf heating of ions in a plasma and recent work indicating that copious production of metal ions can occur in laser-initiated arcs. The investigation will explore the possibility of developing a new class of electromagnetic isotope separators. The underlying view in this work will not be to evolve a design for a separation unit per se, but rather to attempt to understand the basics to an extent that reasonable guesses can be ventured as to feasibility.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

8.0015, LIQUID AND SOLID HELIUM AT VERY LOW TEMPERATURES
E.D. ADAMS, State University of Fla. Sys., School of Arts & Sciences, *Gainesville, Florida* 32601 (DMR77-13933)

Research begun under NSF grant No. DMR75-19548 will be continued and extended. The properties of liquid and solid helium-3 will be investigated with special emphasis on nuclear spin ordering and the associated magnetic properties of solid helium-3. Experiments on liquid helium include measurements of: 1) specific heat and the thermodynamic pressure, 2) nuclear magnetic resonance in the flowing superfluid, and 3) viscosity of the normal fluid.

Experiments on solid helium include: 1) high field effects on the pressure and entropy, 2) a variety of nuclear magnetic resonance studies on the solid produced by compressional cooling, and 3) nuclear demagnetization of solid helium-3. A major aspect of the work is the completion of a nuclear demagnetization facility.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0016, RADIATIVE CAPTURE REACTIONS INDUCED BY NEUTRONS AND BY POLARIZED AND UNPOLARIZED CHARGED PARTICLES
R.A. BLUE, State University of Fla. Sys., School of Arts & Sciences, *Gainesville, Florida* 32601 (PHY77-07217)

This research is a collaborative effort of personnel from the University of Florida and the Triangle Universities Nuclear Laboratory (TUNL) at Duke University. Nuclear giant resonances will be examined using charged particle-gamma-ray capture reactions. Experiments will be carried out at TUNL using the cyclo-Graaff accelerator and a 10 inch by 10 inch NaI scintillator gamma-ray detector. Both polarized and unpolarized proton beams will be used to study the isospin-splitting of giant dipole resonances, and to search for isovector giant quadrupole resonances. The utility of the complementary neutron-induced capture reactions will be investigated as will polarized deuteron capture reactions.

This work is a continuation of that supported by grant No. PHY74-13943 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0017, QUANTUM THEORY OF MOLECULES AND SOLIDS
S.B. TRICKEY, State University of Fla. Sys., School of Arts & Sciences, *Gainesville, Florida* 32601 (DMR76-84577)

Theoretical investigations of the electronic structure and properties of condensed matter previously supported by DMR-7101175 will be continued. Local density models for many-electron systems will be explored and exploited in these studies.

This program involves development of efficient computing techniques which avoid, at least partly, the 'muffin-tin' approximation and will provide the basis for: a) computation of quantities of experimental interest that are not directly expressible in terms of electronic energies; b) investigation of the practicality of recent developed mathematical schemes (generator coordinate method) for obtaining improved many-electron wavefunctions. Work begun under the previous grant to treat the interaction of molecules with metallic surfaces (fundamentals of catalysis) will continue. Adsorption of hydrogen, oxygen, carbon and sulphur on nickel surfaces is currently under study, with emphasis on appropriate treatment of spin-polarization and non-muffin-tin effects. Improved calculations of crystalline defect properties and of the details of photo-emission spectra from Xo and similar models will be done.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0018, KINETIC POLARIZATION DEFICIENCY IN CONDUCTING SOLUTIONS
B. KURSUNOGLU, Univ. of Miami, School of Arts & Sciences, *Miami, Florida* 33124 (CHE77-16964)

The exceptionally large mobilities of intrinsic ions in proton bonded solvents like alcohols, water and formic acid indicate that these ions move to a significant extent by intermolecular jumps of protons. It seems reasonable to expect kinetic depolarization similar to that which occurs in ice.

The question addressed is whether the phenomenon might be general. The appropriate computation will be completed with a model of a viscous liquid dielectric with a finite dielectric relaxation time and negligible viscous relaxation time. A completely self-consistent set of ground rules has been developed. Previous results on dielectric friction will be revised as needed and exact solution of the flow equation will be employed.

The means to compute flow fields and electric moments for steady conduction are at hand. The complications arising from alternating fields remain to be explored.

This research is a continuation of that currently supported by Foundation Grant, CHE-7517533.

SUPPORTED BY U.S. National Science Foundation, Div. of Chemistry

8.0019, AN EPR-ENDOR STUDY OF EXOELECTRON EMISSION TRAPS IN CERAMIC AND SINGLE CRYSTALLINE BERYLLIUM OXIDE

A.K. GARRISON, Emory University, Graduate School, *Atlanta, Georgia* 30322 (DMR77-00314)

Continuation of research supported under DMR75-03281.

Electron nuclear double resonance (ENDOR) will be used to characterize the traps involved in exoelectron emission (EE) in the crystalline and ceramic forms of BeO which have been previously exposed to ionizing radiation. Since thermally stimulated EE (TSEE) is the basis for a sensitive radiation dosimeter made from ceramic BeO, the aim of the study is not only to increase the understanding of the basic EE processes but also to aid in the development of a more reliable TSEE detector.

Initial ENDOR studies done by the co-principal investigators have shown that lithium is present in the BeO ceramic dosimeter material at levels at least two orders of magnitude above that previously known. It serves as a charge trap and may be the primary trap in the exoelectron and luminescence processes. Once all the paramagnetic traps are characterized by ENDOR, it is proposed to use the ENDOR signals as unique microscopic probes into the role of these traps in the EE processes. This will be done by combining ENDOR measurements with TSEE and thermoluminescence (TL) readout, optical stimulation of the traps, various radiation and annealing treatments, electron paramagnetic resonance (EPR) kinetic studies and electric conductivity measurements.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0020, THEORETICAL STUDIES OF THE INTERACTION OF RADIATION WITH MATTER

S.T. MANSON, Georgia State University, School of Arts & Sciences, *Atlanta, Georgia* 30303 (PHY76-80123)

Research in theoretical atomic physics initiated under NSF Grant PHY72-05156 A01 will be continued. This research will focus on: 1. Investigate within the framework of Born approximation, the energy and angular distribution of electrons ejected by fast charged particle impact ionization of atoms. 2. Calculate, within the same framework, inelastic scattering form factors, generalized oscillator strengths, and energy loss cross sections for fast charged particle impact ionization of the atomic subshells of selected elements, as well as to determine their contributions to the total ionization cross section and stopping power. 3. Study the angular distribution of photoelectrons from open shell atoms, where the effects of anisotropic interactions play an important role, as well as other topics of interest in photoelectron spectroscopy such as satellite lines. 4. Explore the behavior of the cross section for the photoionization of selected excited states of various atoms. The results of the calculations will serve to provide further insight into the basic nature of these fundamental atomic processes which are of importance in plasma physics, atmospheric, solar, and astrophysics, radiation physics and for studies of the transport of energy from the site of thermonuclear reaction.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0021, STUDY OF HIGH-ENERGY HADRON REACTIONS WITH A MULTIPARTICLE SPECTROMETER

R. ABRAMS, Univ. of Illinois, School of Liberal Arts & Sci., *Chicago, Illinois* 60607 (PHY77-20959)

Analysis of two experiments (E260 and E110) performed at the Multiparticle Spectrometer located at Fermilab during 1976 and 1977 will be continued. The experiments, performed in collaboration with groups from UCLA, California Institute of Technology and Fermilab, are intended to study the properties of the dynamics of strong interactions at energies of the order of 200 - 400 GeV. Experiment E260 was a study of high transverse phenomena with a particular emphasis on the production of hadronic jets and had an important bearing on the idea of quark-quark scattering. Experiment E110 emphasizes the peripheral production of multiparticle states and attempts to define the production of exclusive hadronic states. It is anticipated that analysis of these experiments will be completed under this grant.

This work represents a continuation of that currently supported by Foundation grant PHY73-04640 A03.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0022, THEORY OF ELECTRON CORRELATIONS AT METALLIC DENSITIES AND ITS APPLICATIONS

K.S. SINGWI, Northwestern University, Graduate School, *Evanston, Illinois* 60201 (DMR77-09937)

This is a continuation of research previously supported by NSF grant DMR 7619863.

Theoretical investigations of the many-body problem of electron correlations and the dynamical behavior of electrons at metallic densities will be continued. The self-consistent theory which was developed previously will be extended and applied to a number of condensed matter systems including the electron-hole condensate in semconductors, metallic surfaces and protons or positive muons in metals.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0023, A THEORETICAL STUDY OF NUCLEAR STRUCTURE AND INTERMEDIATE-ENERGY NUCLEAR REACTIONS

J.T. LONDERGAN, Indiana University, School of Arts & Sciences, *Bloomington, Indiana* 47401 (PHY77-07656)

Research in theoretical nuclear physics initiated under NSF grant PHY75-07803 A01 will be continued. Topics to be investigated include: I. Electromagnetic Interactions. A) Theory of the (gamma, N) interaction at medium energies (Londergan, Nixon), B) Formulation and investigation of intermediate isobar production in (e,electron) and (e,electron p) (Londergan, Walker, Conte). II. Nucleon-Nucleus Interactions. A) Continuation of ongoing program in (p,p), (P,2p) and (p,d) reactions with emphasis on interpretation of new data and model studies of two-step processes, (Walker, Picklesimer). B) Field theoretic and multiple scattering formalisms (Londergan, Weiss). III. Pion Physics. A) Microscopic field theoretic pion-bound nucleon and pion-nucleus formalism (Walker). B) Pion-nucleus quasi-elastic scattering (Walker). C) Study of the pion-nucleon inverse problem with isobars (Londergan). IV. Weak Interactions. Muon production by medium-energy protons (Walker, Weiss). V. Kaon-Nucleus Interactions. The K ion probe as a tool for studying nuclear structure with emphasis on inelastic scattering and knockout reactions (Walker). VI. Heavy Ion Physics. VII. Nuclear Structure.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0024, FUNDAMENTAL PROCESSES AND INTERACTIONS IN METALS

J.C. SWIHART, Indiana University, School of Arts & Sciences, *Bloomington, Indiana* 47401 (DMR77-10549)

Research begun under NSF grant No. DMR73-07590 will be continued and extended. The fundamental interactions which cause or might cause superconductivity will be studied with special emphasis on the electron phonon interaction. Calculations of the electron lifetime and phonon mass enhancement as a function of position on the Fermi surface will be undertaken. The transport properties, the thermopower, and electromigration will be investigated. A second broad area of research will be a theoretical study of the connection between infrared absorption data and the strength of the electron-phonon interaction. The role of impurities in the absorption process will be investigated.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0025, RAMAN AND PHOTOLUMINESCENCE STUDIES OF PURE AND IMPLANTED CUPROUS OXIDE
A.D. COMPAAN, Kansas State University, School of Arts & Sciences, *Manhattan, Kansas* 66506 (DMR76-00371)

A series of experiments will be performed to study exciton interactions in high-purity CU2O. A high-power (100kW) pulsed dye laser will be used to create exciton densities large enough to observe changes in the photoluminescence spectrum due to exciton-exciton scattering and resulting changes in exciton thermalization at high densities. Resonance Raman scattering (RRS) will be used to elucidate details of the exciton-phonon scattering mechanisms, and luminescence lifetimes will be studied with the nanosecond resolution of the pulsed dye laser and a time-to-amplitude converter. Raman and luminescence studies of ion-implanted Cu2O will also be conducted, This program will include RRS studies of implantation-produced damage and of the annealing behavior of damaged Cu2O, photoluminescence and RRS studies of impurity states, and lifetime measurements of impurity states.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0026, THEORETICAL STUDIES OF GRAVITY
C.W. MISNER, Univ. of Maryland, School of Arts & Sciences, *College Park, Maryland* 20742 (PHY76-20029 A01)

Research will deal with 1) the characterization of 'acceptable' naked singularities in the context of exploding black holes and topology change, 2) improved mathematical definitions of superspace, and 3) studies of properties of the Einstein equations which become interesting in view of current efforts to produce numerically computed solutions.

This work represents a continuation of that currently supported by Foundation grant PHY74-18386 AO1.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0027, THEORETICAL STUDIES OF THE QUANTUM LIQUIDS AND SOLIDS
R.A. GUYER, Univ. of Massachusetts, School of Arts & Sciences, *Amherst, Massachusetts* 01002 (DMR76-14447 A01)

Work begun under NSF grant DMR76-14447 will be continued and extended. Theoretical studies of quantum solids and fluids will be undertaken with special emphasis on helium-3 and helium-4. Magnetism in solid helium-3 will be investigated using the Heisenberg field approximation to calculate the magnetic and thermal properties. The current data base for solid helium-3 is not self-consistent at present and the source of this discrepancy will be sought. In another area, diffusion of the two-dimensional lattice gas for both helium-3 and helium-4 will be studied for comparison with experimental studies of monolayers adsorbed on grafoil. Problems of registry, vacancy tunneling, and phase transitions in monolayer systems will be investigated. A new area of research in the study of solitons and non-linear effects in quantum systems will be undertaken.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0028, NEUTRON SCATTERING STUDIES IN URANIUM AND THORIUM
L.E. BEGHIAN, Univ. of Lowell, School of Pure & Applied Scis., *Lowell, Massachusetts* 01854 (ENG74-21835 A02)

The research deals with neutron inelastic scattering cross-section measurements in materials of current interest in the determination of factors such as neutron flux shape, breeding ratios and Doppler effect. Critical to such parameters is the shape of the low-energy spectrum. Part of the research will be to complete the first phase of the work on eta gamma and eta lambda cross sections. Another part deals with preliminary measurements of 232Th cross sections and to initiate measurements of lambda, gamma and cross sections for which instrumentation has been developed. The research involves neutron inelastic cross-section measurements for low-lying states in 232Th, involving high-energy transfer and large neutron energy losses. The research follows that done under NSF Grant ENG-7421835.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

8.0029, MONOLAYER FILMS ADSORBED ON HIGHLY UNIFORM, WELL-ALIGNED GRAPHITE SUBSTRATES
M. BRETZ, Univ. of Michigan, School of Lit. Sci. & The Arts, *Ann Arbor, Michigan* 48104 (DMR76-20369 A01)

Research begun under NSF grant No. DMR76-20369 will be continued and extended. Monolayer films physisorbed on highly uniform, well-aligned graphite substrates will be studied with special emphasis on phase transitions and the effects of substrate bonding. Grafoil and UCAR-ZYX graphite will be used as substrates. Heat capacity measurements will be made for low-coverage helium monolayers to follow liquefaction into regions not previously accessible. Multilayer heat capacity measurements will be made on ZYX graphite to check capillary and geometry effects. A comparative study of mass flow, third sound, and persistent currents will be made. As time and resources permit, an AC heat capacity measurement on a cleaved single-crystal graphite surface will be undertaken.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0030, ENERGY TRANSPORT IN MOLECULAR SOLIDS
R. KOPELMAN, Univ. of Michigan, School of Lit. Sci. & The Arts, *Ann Arbor, Michigan* 48104 (DMR77-00028)

Exciton energy transport in disordered molecular aggregates is being investigated theoretically and experimentally. The theoretical formalism involves percolation, i.e., motion through a randomly disordered medium. Long-range exciton motion in such a molecular solid requires a connected cluster of molecules having an energy band that is accessible to the given exciton. This band is usually lower in energy than all the bands of the 'inaccessible' molecules. Characteristic of percolation phenomena is a drastic change in percolation (i.e., exciton mobility) at a critical value of an order parameter (i.e., concentration of accessible molecule), analogous to the critical behavior of the magnetization at a Curie point.

The theoretical study involves a refinement of the percolation criteria, with emphasis on the distinct results obtained for excitons with short-range interactions (i.e., electron exchange) and long-range ones (i.e., dipole-dipole). The distinction between coherent exciton motion and diffusion-type motion will also be investigated for randomly disordered lattices.

Experimentally, exciton transfer is being examined in chemically and isotopically mixed crystals under steady state and pulsed, wide-band and very narrow-band photon excitation. The aim is to study the time development of exciton transport, trapping and fusion, for a range of 'order parameters' (i.e., concentration, electric field, photon and phonon flux). Research supported under DMR75-07832 A01; first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0031, ELECTRON TRANSPORT AND MAGNETIC INTERACTIONS IN METALS
J. BASS, Michigan State University, School of Arts & Letters, *East Lansing, Michigan* 48824 (DMR77-04680)

Experimental studies of low-temperature transport properties previously supported by DMR7514138 will be continued. Magnetothermoelectric measurements on simple metals at low and ultra-low temperatures will be done in order to achieve a better understanding of many-body effects in thermoelectricity (i.e., electron-phonon mass enhancement and the Nielsen-Taylor effects) and of the source of the Giant Magnetothermopower Oscillations which were discovered in aluminum and indium in recent research done in this project. Also, the sources and properties of the recently discovered low- and ultra-low-temperature

thermoelectric anomalies in tungsten will be investigated. Finally the studies of dilute magnetic alloys using the technique of combining traditional transport and magnetic measurements with direct and independent determinations of the microscopic spatial distribution of impurities will be continued.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0032, THEORIES OF QUARKS AND LEPTONS
T. CHENG, Univ. of Missouri, School of Arts & Sciences, *St. Louis, Missouri* 63121 (PHY76-09798 A01)

Research will concern some of the fundamental properties of the basic fermions, quarks and leptons, in particle physics. The masses of the current-quarks will be studied through broken chiral symmetry. A number of 'exotic' effects such as lepton member non-conservation, induced neutrino mass, etc., will also be studied.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0033, PULSED MAGNETIC RESONANCE AND OTHER STUDIES AT LOW TEMPERATURES
R.E. NORBERG, Washington University, School of Arts & Sciences, *St. Louis, Missouri* 63130 (DMR76-18863)

In this continuation of work carried out under NSF grant DMR72-03183 a series of experiments will be performed on defects, diffusion, and quantum solids and liquids at low temperatures. This work will include measurements of ultra-slow diffusion and quadrupole-defect interactions in solid krypton. Some of these high-precision pulsed NMR measurements will make use of adiabatic demagnetization in the rotating reference frame (ADRF) techniques. Related measurements on interdiffusion and defects in liquid and solid dilute mixtures Kr-Ar and Kr-Xe will be made. Additional quadrupole-defect studies will include novel experiments on hydrogen in metals. A program of measurements of the diffusion and relaxation of light impurity atoms in condensed rare gases will continue with NMR studies of dilute H2 and He3 in liquid and solid neon and argon. A related experiment will study He3 deposited on He4 films. Another continuing experiment will employ collimated phonons in a search for direct evidence of surface excitations at the solid He II interface.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0034, HIGH-ENERGY SCATTERING OF HADRONS AND OF A NEW FORMULATION OF SCATTERING THEORY
C.E. JONES, Univ. of Nebraska, School of Arts & Sciences, *Lincoln, Nebraska* 68508 (PHY76-14438 A01)

This work represents a continuation of Foundation grant PHY74-13873AOl.

Research will investigate consistent behaviors for the high-energy scattering of hadrons and also study a new formulation of scattering theory. More specifically there will be: 1) Study of what classes of growing asymptotic behavior for total and inclusive cross sections of strongly interacting particles can be made compatible with the requirements of direct channel unitarity both in the region of phase space governed by the triple-Pomeron exchange and that region consisting of two high-mass clusters separated by a large rapidity gap. Also examination of the constraints placed on growing asymptotic high energy behavior by partial-wave unitarity. 2) Study of the experimental and theoretical limitations on the possibility that the Pomeron be a simple Regge pole with intercept below one. 3) Pursuit of the development of a new formulation of scattering theory which expresses both the scattering matrix and scattering amplitude in terms of a path integral.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0035, QUANTUM FIELD THEORY WITH DENSITY, TEMPERATURE, AND MAGNETIC FIELD CONSTRAINTS
B.J. HARRINGTON, Univ. of New Hampshire, Graduate School, *Durham, New Hampshire* 03824 (PHY77-11521)

Research into several aspects of quantum field theory in a physical medium will be carried out. Questions concerned with the behavior of matter under extreme astrophysical conditions of high density, temperature, and external magnetic field are used to motivate studies in two principal areas: the electromagnetic structure of cold dense matter and collective effects in non-Abelian gauge theories.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0036, QUANTUM SOLIDS AND THIN HELIUM FILMS AT LOW TEMPERATURES
J.G. DAUNT, Stevens Institute of Technol., School of Engineering, *Hoboken, New Jersey* 07030 (DMR77-09938)

Research begun under NSF grant No. DMR75-02440 will be continued and extended. The properties of the quantum solids comprising solid hydrogen, solid deuterium, and mixtures of the two isotopes will be studied to search for new ordered phases below 0.3 Kelvin. Specific heat and nuclear magnetic resonance measurements will be the primary diagnostic tools. In a second area of research, two-dimensional helium films physisorbed on various homogeneous substrates will be studied in order to determine the character of phase transitions in two-dimensional systems. Helium-4, helium-3, and mixtures of the two isotopes will be studied for several substrates including regular grafoil and UNCAR-ZYX grafoil.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0037, NONLINEAR BEAM-PLASMA INTERACTION
M. SEIDL, Stevens Institute of Technol., Graduate School, *Hoboken, New Jersey* 07030 (PHY77-07214)

Interaction of strong electron beams (beam density larger than one percent of plasma density) with magnetoplasma will be studied experimentally. The ratio of the beam injection velocity to the thermal velocity of plasma electrons will be varied in wide margin (from 3 to 200). Nonlinear processes responsible for the interaction will be identified and their role in the development of plasma turbulence will be evaluated. The instabilities resulting from the coupling of collective and atomic processes will be studied.

This work is a continuation of that currently supported under NSF grant number PHY75-11188A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0038, THEORETICAL SOLID-STATE PHYSICS
E. ABRAHAMS, Rutgers The State University, School of Arts & Sciences, *New Brunswick, New Jersey* 08903 (DMR76-23330 A01)

Research in theoretical solid-state physics carried out under grant DMR72-03230 will be continued. In particular, the program will be directed toward three general problems: (1) Transport coefficients of the normal Fermi liquid will be calculated by extending Eliashberg's theory to include finite temperature corrections. (2) The coupling of electrons to sound waves in piezoelectric materials will be studied, including the effect of this coupling on transport properties. (3) Research on dynamical phenomena near the lambda transition in liquid helium will be continued.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0039, THEORETICAL NUCLEAR PHYSICS
C.M. SHAKIN, City University of New York, Graduate School, *Brooklyn, New York* 11210 (PHY77-05016)

Research in theoretical nuclear physics initiated under NSF grant PHY75-06932 A01 will be continued. Topics to be in-

vestigated include: 1. pion physics; a. pion-nucleus scattering; b. pion creation and absorption; 2. deuteron-nucleus collisions; 3. many-body theory; 4. heavy-ion physics; a. foundations of TDHF theory for heavy-ion collisions; b. heavy-ion collisions at medium and high energies; 5. three-body problem at medium and high energies; 6. general scattering theory; 7. scattering of electrons by nuclei.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0040, EFFECT OF LIBRON-PHONON INTERACTION ON THE IR ABSORPTION SPECTRA
S. FUJITA, State University of New York, School of Natural Sci. & Math., *Buffalo, New York* 14214 (9505-AC6)

We propose theoretical researches on the optical properties of inert-gas-atom crystals (and liquids) with molecular impurities and polymers in glassy state. Constructing simple models and using Green's functions, and Kubo's formalism, we study the infrared (IR) absorption spectra, taking into account the dynamical correlation between molecules and their environments. We believe that the researches proposed are significant not only in the basic understanding of the phenomena but also badly needed in the quantitative analysis. Specific problems we describe below are: a) Libration (hindered rotation) of diatomic molecules in a fluctuating phonon field in three dimensions, b) Diatomic molecules in a liquid solvent, c) Libration of side-elements of a high polymer in a glassy state, d) Basic foundations of the theory for solids and liquids.

SUPPORTED BY American Chemical Society

8.0041, LIMITED DIMENSIONALITY AND SURFACE EFFECTS IN METALLIC SYSTEMS
R.A. BUHRMAN, Cornell University, Graduate School, *Ithaca, New York* 14850 (DMR77-09879)

Experimental research on the electronic and magnetic properties of metals in limiting and unusual physical environments previously supported by DMR-7402609 will be continued. Static and dynamic transport techniques and resonance techniques will be used to investigate the quantum phenomena arising from size effects in microminiature metallic particles. The intent of this research is to advance the understanding of the transition regime between metallic and atomic-like behavior in such systems. The magnetic susceptibility of metals at or near free surfaces will be investigated by the use of high-resolution susceptibility measurements. A new surface-sensitive magnetic probe that is proposed for development will also be used. An exploratory investigation of the electrical and magnetic properties of ultra-finely dispersed cermet materials will be initiated.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0042, ELECTRON SPECTROMETRY OF SOLID SYSTEMS
J. SILCOX, Cornell University, School of Engineering, *Ithaca, New York* 14850 (DMR76-00834 A01)

This is a continuation of research previously supported under DMR-7600834.

Studies of the excitation spectrum of solid-state systems using an electron microscope/electron spectrometer system will be carried out. For thin-film specimens, both bulk and surface excitations will be detected. A variable low-temperature stage will be constructed in order to develop precise prescriptions for subtracting multiple scattering effects arising from thermal vibrations and for studies of transitions in the electronic structure of the specimens in question. Systems chosen for study will include aluminium and may include copper and silicon or germanium. Examples drawn from one- and two-dimensional anisotropic systems and amorphous materials will also be studied. Niobium-vanadium-selenium layer compounds will be studied at different temperatures in order to clarify the nature of the transitions in magnetic susceptibility observed by other workers. Also, single-crystal studies of scattering will be initiated to identify multiple scattering features associated with quasi-elastic events.

This is the second year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0043, RESONANCE PHYSICS
S.R. HARTMANN, Columbia University, School of Arts & Sciences, *New York, New York* 10027 (DMR77-05995)

The relaxation behavior of rare-earth ions in laser-quality host materials will be investigated using pulsed photon spectroscopy. Photon echoes (the optical analogy to spin echoes) can provide information about the time-dependent behavior of the excited atomic states in crystals. Apparatus capable of 'long' pulse delays (nanosecond) will be built so that Photon Echo Nuclear Double Resonance (PENDOR) experiments can be done to obtain information about the basic hyperfine interaction Hamiltonian. This apparatus will provide reliable measurements of the echo amplitude as a function of pulse separation. Studies of phonon induced relaxation will be continued using the hole burning technique of Szabo and the stimulated echo technique to study cross relaxation. The analogues of pulsed NMR will be explored.

This is a continuation of research supported under DMR73-07600.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0044, ITINERANT ELECTRON ANTIFERROMAGNETISM AND LOCALIZED MAGNETIC MOMENTS
S. ARAJS, Clarkson College of Technology, Graduate School, *Potsdam, New York* 13676 (DMR76-09198)

A very basic problem in the field of magnetism - the behavior of localized magnetic moments in an itinerant electron antiferromagnetic matrix - will be studied. Currently, there is considerable research activity in the related areas of conventional spin glasses and micromagnetism. The scope and the understanding of this field of magnetism will be extended by carrying out theoretical calculations and high-accuracy experimental investigations (magnetic susceptibility and electrical resistivity) on chromium alloys containing localized moment solutes such as iron, cobalt, and manganese. Theoretical and experimental studies of the temperature dependence of the magnetic susceptibility of pure chromium and binary chromium alloys without localized moments will be carried out. This research will address the problem of the static magnetic properties of itinerant electron antiferromagnets and open a new area of research activity dealing with the behavior of localized moments in such systems.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0045, EXPERIMENTAL STUDIES OF GRAVITATION - GRAVITATIONAL RADIATION
D.H. DOUGLASS, Univ. of Rochester, School of Arts & Sciences, *Rochester, New York* 14627 (PHY77-07315)

Research will continue on the design and operation of gravitational wave detectors of greatly increased sensitivity. A conventional room-temperature detector has been improved, and will continue in operation to search for signals at a level of 1 GPU. The feasibility study on dielectric detectors will be completed, and a small silicon crystal will be used as an antenna. Future work will include construction and use of a large (100 Kg) crystal cryogenic detector which is expected to have a sensitivity in the range of 10 to the minus 3rd power to 10 to the minus 7th power GPU.

This work is a continuation of that currently supported under NSF grant number PHY72-04755 A05.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0046, PHONON PHYSICS
E.H. JACOBSEN, Univ. of Rochester, School of Arts & Sciences, *Rochester, New York* 14627 (DMR77-01071)

This research is a continuation of that supported by DMR75-09567. The principal objective of this research is to study the phenomenon of 'time-reversed' phonon echoes at 70 GHz in

piezoelectric semi-conductors and ferroelectrics. There are two classes of echo-generating processes: (1) in piezoelectric semiconductors, echoes are created by either a stationary or moving charge grating, whereas (2) in ferroelectrics the process is connected with two-level tunneling systems. There are many unanswered questions for both types of echo phenomena which may be profitably studied at ultra-microwave frequencies. Also, time-reversed phonon echoes can be used to gain considerable sensitivity over a wide frequency range. Finally, the stored charge grating in a piezoelectric semi-conductor closely resembles a holograph. Thus, if this sound field can be read out properly, it will be possible to perform ultrasonic microscopy at high resolution and with unique features of contrast.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0047, ELECTROMAGNETIC RADIATION AND ITS INTERACTION WITH MATERIAL MEDIA 9407-P

E. WOLF, Univ. of Rochester, School of Arts & Sciences, *Rochester, New York* 14627 (DA0C9188; DAHC04-74-G-0014)

To study the interaction of electromagnetic radiation with bulk matter. The work is relevant to a host of outstanding Army barrier problems such as the propagation of laser radiation in the turbulent atmosphere, to the development of analogues of optical components for wavelengths shorter than the visible, to the problem of laser 'window' material damage, and to nonlinear optics in general.

Areas of research will include (1) electrodynamics of spatially dispersive media, (2) molecular optics, (3) coherence effects in the interaction of quantized fields with matter.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense, Army

8.0048, OPERATION OF THE STONY BROOK NUCLEAR STRUCTURE LABORATORY

D.B. FOSSAN, State University of New York, School of Arts & Sciences, *Stony Brook, New York* 11790 (PHY77-10192)

This work is the continuation of research carried out under National Science Foundation grant PHY75-11185A02. The program will center on a tandem Van de Graaff accelerator and associated experimental equipment. Major pieces of general equipment include a 30-inch precision scattering chamber, lithium drifted germanium and sodium iodide gamma-ray detectors, a superconducting magnet for nuclear moment measurements, as well as general-purpose electronics, oscilloscopes and multichannel analysers.

Studies will include measurements of g-factors and quadrupole moments of isomeric nuclear states, isomeric fission, intermediate structure in heavy-ion-induced reactons, macroscopic properties of nuclei and nuclear-atomic interactions. Studies of a superconducting linear accelerator are in progress aimed at providing additional acceleration capability.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0049, MOLECULAR MOTION AND NUCLEAR MAGNETIC RELAXATION

P.S. HUBBARD, Univ. of North Carolina, School of Arts & Sciences, *Chapel Hill, North Carolina* 27514 (DMR73-02626 A03)

Theoretical research on the following topics involving molecular motion and spin relaxation will be carried out. (1) Continuation of the development of the Langevin model of rotational Brownian motion, including calculations of the motion and nuclear magnetic relaxation of nonspherical molecules, and comparison of calculated and experimental results. (2) Investigation of questions arising in connection with some calculations of molecular motion employing Zwanzig- and Mori-type projection operators. (3) Applications of the Argyres and Kelley theory of spin relaxation to situations which cannot be adequately described by the Bloch-Redfield theories.

This is a continuation of research supported under DMR73-02626.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0050, LOW-TEMPERATURE PHYSICS

H.A. FAIRBANK, Duke University, School of Arts & Sciences, *Durham, North Carolina* 27706 (DMR77-11686)

Research begun under grant DMR73-07605 will be completed. The fundamental physical processes which occur in quantum solids and liquids will be investigated. Studies of the liquid phase include dielectric constant measurements and zero sound measurements and zero sound measurements for superfluid helium-3 below 0.0003K. Studies of the solid phase include heat flow measurements for high-quality single crystals of bcc helium-3 and hep helium-4. Several unresolved questions peculiar to the basic heat flow process in bcc helium-3 will be investigated.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0051, ISOSPIN EFFECTS IN NEUTRON SCATTERING AND NEUTRON INDUCED CHARGED PARTICLE REACTIONS

J. RAPAPORT, Ohio University, School of Arts & Sciences, *Athens, Ohio* 45701 (PHY76-11450 A01)

The elastic and inelastic scattering of neutrons at several energies between 7 and 25 MeV continue to be studied. Elastic scattering data will be interpreted in the framework of the nuclear optical potential. Comparison with proton data will permit extraction of isospin-dependent terms in this potential. The possible isospin dependence of the inelastic scattering processes will also be tested against nuclear structure and reaction models. New work will employ a high-efficiency neutron detector to study (p.n) change exchange reactions at the Indiana University cyclotron facility in order to find the isospin composition of the nuclear giant resonance states.

The research is a continuation of work supported by NSF grant PHY76-11450.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0052, THEORETICAL ELEMENTARY-PARTICLE PHYSICS

R.W. BROWN, Case Western Reserve Univ., Graduate School, *Cleveland, Ohio* 44106 (PHY76-12245 A01)

One of the most important searches to be performed with the next-generation high-energy accelerators will be the search for the W-boson, the hypothetical particle which is the carrier of the weak beta decay force. A study (in progress) of the practicality of looking for the W-boson with different accelerators in various ways will continue. More formal studies in quantum field theory will also be carried out. This work represents a continuation of that currently supported by Foundation grant PHY76-12245.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0053, NUCLEAR PHYSICS RESEARCH WITH A 7 MV VAN DE GRAAFF ACCELERATOR

H.J. HAUSMAN, Ohio State University, School of Math. & Phys. Scis., *Columbus, Ohio* 43210 (PHY77-05021)

This grant will provide funds for operation of the Van de Graaff Laboratory, and nuclear physics research at O.S.U., as well as user-mode research at the Indiana University cyclotron laboratory. The in-house research program is well suited to the facility which contains a seven million volt Van de Graaff accelerator and extensive ancillary experimental apparatus. Techniques which have been developed, or utilized, at Ohio State will be applied to interesting problems which include: the spectroscopy of selected nuclei; the charge independence of the nucleon-nucleon force; the cross sections of nuclear reactions crucial to stellar nucleosynthesis; and atomic ionization phenomena induced by beams of helium isotopes. Much of the work will exploit the high-quality polarized proton or deuteron beams now available.

Research at Indiana on intermediate-energy proton capture reactions is designed to search for high-angular-momentum collective vibrations of nuclei and high-linear-momentum components or low-lying states of nuclei.

This work is a continuation of that currently supported by NSF grant PHY74-08524 A02.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0054, THEORY OF SOLIDS

G.H. WANNIER, Oregon State Higher Educ. Sys., School of Liberal Arts, *Eugene, Oregon* 97401 (DMR77-06736)

Continuation of research supported under DMR76-18880.

The theoretical problem of a crystal in a magnetic field will be investigated. This problem has not yet been solved rigorously, but some approximate solutions are known and some group-theoretic properties have been established. These approaches will be examined and extended.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0055, DEFECT ASSOCIATION IN TERNARY OXIDES

D.M. SMYTH, Lehigh University, Materials Research Center, *Bethlehem, Pennsylvania* 18015 (DMR74-21095 A01)

This program continues the study of the defect chemistry of perovskite-structure, ternary oxides, using the techniques established during the past two years. BaTiO3 continues to receive major attention, with particular emphasis on: (1) the behavior of donor-doped samples where it appears that the defect complexes related to BaO-deficiency may be participating in the oxygen equilibration reactions, (2) the mechanism whereby highly donor-doped samples accommodate a stoichiometric and crystallographic excess of oxygen which compensates the donor and yields an insulating material, (3) the transition of acceptor-doped samples from high conductivity at elevated temperatures to high resistivity at room temperature, (4) the crystal site occupied by selected impurities as a function of Ba/Ti ratio, and (5) evidence for the existence of defect complexes by means of dielectric and mechanical relaxation measurements. A further major aspect is the introduction of a parallel study on PbTiO3 with independent control of both the O2 and PbO activities through the vapor phase. The feasibility of growing single crystals of PbTiO3 by the Bridgman technique will be explored.

This program continues research done under DMR74-21095.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0056, TRANSPORT AND THERMODYNAMIC PROPERTIES OF MAGNETIC AND NEARLY MAGNETIC SYSTEMS

T.W. MIHALISIN, Temple University, School of Liberal Arts, *Philadelphia, Pennsylvania* 19122 (DMR76-16433 A01)

Research supported under NSF grant DMR72-03172 will be continued. The thrust of the forthcoming investigations will be on investigating: (a) crystalline electric fields, (b) the role of the Kondo effect, (c) effects due to interconfigurational fluctuations on the transport and thermal properties of selected alloys. Among these alloys those of Ce, La, and Pr will be of particular importance. The extreme case of electric field effects, i.e., induced moment systems, will be emphasized. Here attention will be focused on compounds of Pr, Tb and La. The measurements to be made will include resistivity, susceptibility, ultrasonic attenuation and thermopower.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0057, RANDOM MAGNETICS

R. TAHIRKHELI, Temple University, School of Liberal Arts, *Philadelphia, Pennsylvania* 19122 (DMR77-11257)

The static and dynamic properties of exchange coupled macroscopic spin systems in thermal equilibrium will be studied. Systems which are spatially random on the microscopic scale will be considered. Several theoretical procedures will be developed and generalized including the Coherent Potential Approximation (CPA), the High-Temperature Series Expansions, the Spin-Wave and the Random Phase Approximations (RPA) and Monte-Carlo Numerical Simulation Procedures with the use of Renormalization Group Techniques. Specific problems to be considered will include studies of nearly one- and two-dimensional magnetic systems with randomly distributed impurities, CPA-like description of dynamics in interacting spin systems, field-induced phase transitions in randomly diluted antiferromagnets, high-temperature series expansions for random paramagnets, and studies of model spin-glass magnets.

This is a continuation of DMR73-07651.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0058, HIGH TC SUPERCONDUCTING SPUTTERED CERAMIC FILMS

R. ROY, Penn. State University, School of Earth & Min. Sci., *University Park, Pennsylvania* 16802 (DMR75-04510 A01)

Ceramic superconducting compounds represent a relatively new class of materials which have been shown to have high superconducting transition temperatures, Tc's. This study will be directed toward understanding how the crystal chemistry of perovskite compounds, such as barium-lead-bismuth oxide (BaPb1-xBixO3), influence Tc.

Initially, preparation of the perovskite samples will be in the form of ceramic powders and pellets by conventional pressing and sintering techniques. Later studies will involve preparation by RF-sputtering. Chemical characterization will be accomplished by a combination of techniques: electron microprobe, X-ray fluorescence, Auger spectroscopy, and ion scattering spectroscopy. Morphological and structural studies will be done by scanning electron microscopy and X-ray diffraction. Order-disorder studies by X-ray diffraction will be supplemented in some cases by Raman spectroscopy.

This is a renewal of NSF Grant DMR75-04510.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0059, NUCLEAR MAGNETIC RESONANCE STUDIES OF THE STRUCTURE OF GLASSES

P.J. BRAY, Brown University, Graduate School, *Providence, Rhode Island* 02912 (DMR77-08600)

New developments utilizing NMR studies to answer basic scientific questions concerning glass structure will be carried out including the following projects: (1) The O17 NMR spectroscopy of glasses will be used to study oxygen bonding in the alkali borate and silicate systems. (2) Si29 NMR spectroscopy will be completed for glasses and compounds of the system K2O-SiO2 and applied to other alkali and alkaline earth binary silicates and ternary systems. The linewidths and isotropic chemical shifts will also be determined. (3) Newly-developed B10 NMR spectroscopy will be applied to several binary and ternary systems (e.g., Li2O-B2O3 and Na2O-B2O3-SiO2). (4) Recent success in using NMR spectra to determine the structure of glasses in ternary systems will be extended to the systems Na2O-B2O3-SiO2, CdO-TeO-B2O-V2O5, La2O3-B2O3-CdO and K2O3-P2O5. (5) Ionic motion in glasses will be studied by NMR to determine activation energies, extend present studies of diffusion in systems based on SiO2 and B2O3 to glasses based on other oxides and more novel constituents, and test theories for the mixed-alkali effect.

This is a continuation of research begun under NSF Grant No. DMR76-07814.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0060, ATOMIC STRUCTURE AND COLLISIONS EXPERIMENTS ON HIGHLY IONIZED IONS

D.J. PEGG, Univ. of Tennessee, School of Liberal Arts, *Knoxville, Tennessee* 37916 (PHY77-05726)

Research on heavy-ion atomic structure and associated collision phenomena will be continued. In general, the experimental

investigations involve the interaction of accelerated ion beams (often highly stripped) with both solid and gaseous targets. Charge-changing processes and the deexcitation of excited electronic states by both photon and electron emission are used to 'signature' the occurrence of specific collision and radiative phenomena in the target or projectile. In this manner collision cross sections and radiative and autoionizing decay probabilities are measured. In order to span as wide a range of projectile energies, charge states, and species as possible, several different particle accelerators are employed. The group works primarily at the Oak Ridge National Laboratory in the capacity of a university user's group. Experiments are also performed at the University of Tennessee, Brookhaven National Laboratory and occasionally at other sites.

During the next grant period four different kinds of investigations are planned: (1) Structure and Lifetimes of Highly Ionized Ions using Beam-Foil Excitation, (2) Collision and Structure Experiments on Low-Energy Multiply Charged Ions, (3) Collisional Production and Electron Spectroscopy of Core-Excited States of Alkali-Like Systems, (4) Electron Capture by High-Energy Protons in Atomic Hydrogen (in collaboration with J.E. Bayfield and colleagues).

This work is a continuation of that currently supported under NSF grant number MPS72-05159 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0061, X-RAYS, AUGER ELECTRON, AND FLUORESCENCE YIELD MEASUREMENTS FOR MULTIPLY-IONIZED ATOMS AND MOLECULES

C.F. MOORE, Univ. of Texas, School of Arts & Sciences, *Austin, Texas* 78712 (F-261)

A strong variation of the average Ne K shell fluorescence yields omega k with charge state n of incident 45 MeV Cln plus ions was reported by Burch et al. This result and the analysis of highly resolved Ne K Auger and X-ray spectra following energetic oxygen and chlorine ion impact with different charge state, was used to deduce average fluorescence yields for different initial configurations. These semiempirically deduced average fluorescence yields are uncertain because of the complexity of the Auger electron spectra and an uncertainty in the approximation used for the population numbers of the different states. A Li and Be-like Ne K Auger electron spectrum produced by 45 MeV Cl12 plus ion impact on neon with a resolution of 1.5 eV (FWHM) has been measured. A comparison between measured and calculated transition energies leads to the identification of over eighty lines in the spectra. Line intensity variations with projectile energy and charge state were helpful in the deduction of the residual neon ion charge state determination. The relative intensity of the corresponding satellite lines Qi (i equals 1 yields 6) was determined using the relation omega i equals omega Ri/Qi, a omega 6 value was measured to be 0.210.

SUPPORTED BY Robert A. Welch Foundation

8.0062, THERMOMAGNETIC EFFECTS IN POLYATOMIC GASES

T.A. ADAIR, Texas A & M University System, School of Science, *College Station, Texas* 77843 (A-288)

Thermal force and thermomagnetic force measurements have been made on a disk with its surface perpendicular to the heat flux in the gases NO and O2. Comparisons with calculated values have confirmed predictions of thermal force and thermomagnetic force theory. The thermomagnetic torque has been measured in parahydrogen and ortho and normal deuterium at pressures from 0.10 to 2.0 torr and temperatures from 100 to 370 K. Evidence of spin-coupling effects have been found in both deuterium modifications. In parahydrogen the torque at all temperatures and pressures exhibits behavior expected of a gas of zero nuclear spin molecules. Experiment and theory are in excellent agreement for this work. The investigation of the thermomagnetic torque in the polar gases N2O, OCS, and CHF3 has been completed. The data for these gases is similar to that for nonpolar gases with the exception the effect occurs at much larger values of H/p. Theory necessary to compare the polar gas data with calculated values is not yet available.

SUPPORTED BY Robert A. Welch Foundation

8.0063, MICROSCOPIC INVESTIGATION OF SPACE- AND TIME-DEPENDENT SUPERCONDUCTIVITY AND SUPERFLUID HELIUM-3

C. HU, Texas A & M University System, Graduate School, *College Station, Texas* 77843 (DMR76-81328)

In this research program which is currently supported under NSF grant number DMR72-03128 work will continue on the theory of type II superconductivity and some effort will go toward collaboration with Professor Maki on the theory of superfluid Helium-3. The superconductivity parts will include studies of the equations first derived by Gor'kov and Eliashberg for gapless superconductors in view of generalizing them to include heat currents and temperature gradients; studies of the 'anomalous contributions' found by Gor'kov and Eliashberg to the dynamic properties of gapless superconductors; and to extend these equations to finite gap energy. The Bogoliubov-de Gennes theory for inhomogeneous superconductivity will also be investigated using some new mathematical techniques developed by the principal investigator. The work on superfluid He3 will focus on the dynamic properties of the A1 phase, the wall effect in the B phase and vorticity in both A and B phases.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0064, BENT CRYSTAL X-RAY TOPOGRAPHY

D.L. PARKER, Texas A & M University System, School of Engineering, *College Station, Texas* 77843 (NAS 8-32527)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0065, ELECTRON CAPTURE INTO THE 4S STATE OF HYDROGEN BY 10-150 KEV PROTONS ON KRYPTON

B.M. DOUGHTY, East Texas State University, Graduate School, *Commerce, Texas* 75428 (T-561)

Cross sections for electron capture into the 4s state of hydrogen have been measured for 10-150 keV protons incident on krypton. These measurements were performed by directing a monoenergetic proton beam through a differentially pumped chamber containing the target gas and observing the Balmer-beta radiation from the emerging beam. The absolute sensitivity of the apparatus and consequently absolute cross-section values are based upon measurements of Hughes at the University of Arkansas.

The primary maximum for the cross section vs. proton energy curve appears around 25 keV which is reasonably consistent with the predictions of Massey's adiabatic criterion. In addition, there is substantial agreement with an n to the minus 3rd power scaling of the 3s cross-section values as predicted by Born approximation considerations over most of the proton energy range. Dawson and Lloyd have made these measurements for proton energies from 1-8 keV. Minor extrapolations of their curves do not yield satisfactory agreement with these measurements in spite of the fact that both laboratories can trace their absolute calibration to the Arkansas measurement. However, the 3s cross sections of Dawson and those of this laboratory are substantially in agreement.

SUPPORTED BY Robert A. Welch Foundation

8.0066, REACTIVE COLLISIONAL PROCESSES INVOLVING ATOMS, MOLECULES AND SURFACES

N.F. LANE, Rice University, Graduate School, *Houston, Texas* 77001 (C-540)

Theoretical studies of a number of inelastic atomic, molecular and electronic collision processes, in some cases involving a metal surface, have been carried out, in part to provide guidance for the proper description of simple photochemical reactions occurring near metal surfaces. These studies include: improved description of mixing and quenching of excited states of atoms colliding with a metal surface; studies of metallic screening of atomic cores and electron-ion interactions near the metal surface

by means of model and ab initio calculations of energies and wave functions for H-metal systems; new calculations of chemiionization rates for He (21,3S) in H2 gas; first calculation of excitation-transfer rates for excited Ne (Ip1,3Pj) in Ne gas; new calculations of rotational-relaxation rates for Hr, HCl, DF and DCl in He gas; extension of new theoretical methods, developed in the group, and application to e-H2 scattering; first theoretical treatment of e-CO2 scattering-effects of exchange and polarization are included and good agreement with experiment is obtained.

SUPPORTED BY Robert A. Welch Foundation

8.0067, MANY-BODY METHODS FOR ATOMS AND MOLECULES
H.P. KELLY, Univ. of Virginia, School of Arts & Sciences, *Charlottesville, Virginia* 22903 (PHY77-07154)

Research on many-body calculations of atomic and molecular properties initiated under NSF Grant PHY75-08080 A01 will be continued and extended. Photoionization cross sections including resonance and other correlation effects will be calculated. Particular attention will be given to the important process of double electron photoionization and to photoionization with excitation to bound excited states. Calculations will also be made of photoionization cross sections for molecules.

Auger rates will be calculated including correlation corrections, and particular attention will be given to the recently observed process of three-electron Auger rates in argon.

Relativistic corrections for photoionization cross sections and for bound oscillator strengths will be calculated. The effects of electron correlations on matrix elements involving parity violation due to neutral currents will be investigated.

Other properties which will be investigated are molecular Auger rates, oscillator strengths, and photodissociation rates.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0068, PRE-BREAKDOWN MATERIAL MODIFICATIONS AND THEIR EFFECT ON OPTICAL DAMAGE THRESHOLD
P. BRAUNLICH, Washington State University, School of Arts & Sciences, *Pullman, Washington* 99163 (E(45-1)-2221)

The work proposed is a continuation of contract E(45-1)-2221 which is concerned with the investigation of halogen emission from alkali halides during exposure to intense laser beams at a peak flux less than the damage threshold. This effect was found to be strong enough to cause considerable ablation of the exposed surface, thus successively reducing the surface damage threshold. Similar effects are expected to occur in such materials as CdS, ZnS, CdTe, ZnTe, etc.

Our interest is to understand the mechanism of this phenomenon and its impact on dielectric breakdown at optical frequencies. In addition, the mechanism of optical damage at short wavelength itself will be investigated. An initial theory of damage caused by multi-photon polaron generation and lattice heating via polaron photon absorption will be developed such as to include hitherto unknown beam deforming effects.

RESULTS: Observation of strong directional emission of halogen atoms from NaCl, KCl, KBr during exposure to high-intensity laser pulses at peak powers less than the one-shot damage threshold. Development of a 'non-avalanche' theory of dielectric breakdown at optical frequencies.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Laser Fusion

8.0069, GAMMA-RAY AND X-RAY SPECTROSCOPY OF SOLIDS UNDER PRESSURE
R.L. INGALLS, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (DMR76-21053)

Research will be carried out to investigate the structure and behavior of materials at high pressures. Mossbauer effect (recoilless gamma-ray resonance) experiments in magnetic materials will be used to study the magnetic phases and critical phenomena near tricritical points and phase boundaries at various temperature and pressures. Extended X-ray absorption fine structure (EXAFS) experiments will be done in order to study the electronic and structural changes in materials using synchrotron radiation.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, PHOTOGRAMMETRY
S.S. WU, U.S. Dept. of The Interior, Geological Survey, *Flagstaff, Arizona* 86001 (9580-00992)

The objective of the project PHOTOGRAMMETRY is to support geological studies of the Earth, the Moon, and other planets in general, and also to revise the existing 1:25 million topographic contour map of Mars. To support geological studies, the work plan in the current year is to select overlapped photographs from Viking covering geological and/or other scientific targets of interest for photogrammetric measurements either in the form of contour maps or simply profiles. This photogrammetric work will be custom work according to requirements established by appropriate scientists or according to the geologic nature of the ground feature itself.

The Mars map is to be enhanced by using all available topographic data from Viking missions with additional Earth-based radar data.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

10.0002, INTERNATIONAL MEETING AND BOOK ON 'PROTOSTARS AND PLANETS'
A.M. GEHRELS, Univ. of Arizona, School of Liberal Arts, *Tucson, Arizona* 85721 (NSG 7358)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0003, EXPERIMENTAL RELATIVITY BY DAYTIME ASTROMETRY AT SCLERA
H.A. HILL, Univ. of Arizona, School of Liberal Arts, *Tucson, Arizona* 85721 (PHY77-08200)

Research will continue on measurements of the low-frequency solar oscillations discovered recently, and on the definition of the sun's edge. In parallel, the daytime tracking of stars and planets will continue, to determine the gravitational deflection of light passing close to the sun.

This work is a continuation of that currently supported under NSF grant PHY75-11190 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

10.0004, PIONEER VENUS DATA ANALYSIS OF THE SOLAR FLUX RADIOMETER EXPERIMENT
UNKNOWN, Univ. of Arizona, Graduate School, *Tucson, Arizona* 85721 (NAS 2-9486)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0005, ABUNDANCE DETERMINATION FOR THIRTY EXTREMELY METAL-POOR STARS
R. PETERSON, Unknown Inst. or Indiv. Grant, *California* (AST76-18890)

An analysis of the chemical abundance of certain stars in our galaxy will be made. The stars to be considered are stars which appear to have extremely low metal abundances. The analysis of the chemical abundances in these stars is of importance in considering the various mechanisms of nucleosynthesis during the earliest phases of galaxy formation.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0006, THEORETICAL RADIO ASTRONOMY
R.D. BLANDFORD, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (AST76-20375)

Theoretical and interpretative studies in areas specifically related to radio astronomical observations will be carried out. The strong observational group at California Institute of Technology complements this research; and the many important discoveries that have been made in this field over the past few years indicate that such studies are of current scientific interest. Preliminary research has been carried out in specific areas recently and further research will be as follows: a) Studies of the self-consistency and observable features of beam models of extended extragalactic radio sources. The present observational data (especially recent high-resolution observations) favor such models. b) Studies of physical processes likely to be of importance in active galactic nuclei and quasars. Such studies may also be relevant to the extended sources. This research will be related to very-long-baseline interferometric observations. c) Studies of radiative and electromagnetic effects in pulsars, concentrating on possible coherent emission mechanisms and radiative transfer. d) Studies of particle acceleration within supernova remnants and of the Crab Nebula.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0007, SEARCH FOR PERIODIC VARIATIONS IN THE X-RAY FLUX FROM THE GALACTIC CENTER
G. GARMIRE, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (NSG 5197)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0008, SOLAR FLARES
H. ZIRIN, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (DF248780; F19628-77-C-0106)

AF function - communications, surveillance, detection, tracking. Deficiency - inadequate warnings of sun-induced disruptions. Objective - determine the effect of chromospheric structures, motions and magnetic fields on the solar atmosphere and how each contributes to the environment for solar activity. How research contributes - provides the physical knowledge necessary for a sound cause-and-effect prediction technique for solar-induced disruptions.

Collaborative studies with the Sacramento Peak Observatory on the chromosphere to obtain maximum observational data on selected solar events.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH, Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

10.0009, THE ELECTRIC CURRENT STRUCTURE OF THE MAGNETOSPHERE
H. ALFVEN, Univ. of California, Graduate School, *San Diego, California* 92037 (ATM77-12866)

This grant supports an investigation whose primary aim is to transform the representation of magnetospheric physics from the one in terms of magnetic fields to one in terms of electric currents. Two immediate and basic questions, both related to the stability of the current system, will be studied in detail. They are (a) under what circumstances will a volume current collapse into sheet-like or filamentary structure? and (b) under what circumstances will a current structure develop irregularities leading to anomalous resistance and enhanced energy disposition? The global morphology of the current system, its closure and the energy transfer in the magnetosphere, in terms of these currents will also be studied.

As a parallel line of investigation, the researchers will survey magnetospheric physics in order to discover where such current-associated phenomena as double layers and anomalous resistivity are to be found and to study their observational consequence.

A comparative analysis of the terrestrial magnetosphere with that of the Jovian magnetospheres, cometary magnetospheres and the heliosphere is also planned.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0010, OBSERVATIONAL STUDIES IN GALACTIC AND EXTRAGALACTIC ASTROPHYSICS
B.T. SOIFER, Univ. of California, Graduate School, *San Diego, California* 92037 (AST-76-82890)

Infrared spectrophotometric observations of galactic and extragalactic sources will be continued. The University of California, San Diego - University of Minnesota M. Lemmon Observatory will be used. Development of the multi-detector, cryogenically-cooled grating spectrometer will be carried out in order to increase the ultimate sensitivity of infrared spectroscopy.

The infrared observations will consist of moderate resolution (delta lambda/lamda approximately 0.01) spectroscopy from 2-4 microns and 8-13 microns of a variety of galactic and extragalactic infrared sources. Infrared properties of interstellar matter, compact ionized hydrogen (H II) regions and infrared sources found in the Air Force Cambridge Research Laboratory (AFCRL) Infrared Sky Survey will be studied. The extragalactic observations will help define the physical conditions and infrared emission mechanisms in the infrared sources.

A cryogenically-cooled grating spectrometer is being developed to increase the ultimate sensitivity of spectroscopy from 8-13 microns. An array of background-limited photoconductors will be constructed to monitor many wavelengths simultaneously.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0011, REVISION OF YALE CATALOGUE OF BRIGHT STARS AND GENERAL CATALOGUE OF TRIGONOMETRIC STELLAR PARALLAXES
W. VANALTENA, Yale University, Graduate School, *New Haven, Connecticut* 06520 (AST75-17847)

The Yale Bright Star Catalogue and the Yale General Catalogue of Trignometric Parallaxes will be updated with both improved and new data available since the previous editions were published in 1964 and 1963, respectively. A third of the bright stars have had changes or additions to their data. More than 1200 new parallaxes are available. A thorough statistical analysis of the parallaxes will be undertaken to determine the best weighting system and reduction of the results from various observatories to a uniform system. The Stellar Data Center at Strasbourg will collaborate on the work.

Approximately three years will be required to complete and publish both catalogues.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0012, STUDY OF INTERSTELLAR CLOUDS CONTAINING ATOMIC AND MOLECULAR CONSTITUENTS
J.A. SIMPSON, Univ. of Chicago, School of Physical Sciences, *Chicago, Illinois* 60637 (NSG 5202)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0013, OPTICAL AND RADIO STUDIES OF DIFFUSE INTERSTELLAR CLOUDS
R.M. CRUTCHER, Univ. of Illinois, School of Liberal Arts & Sci., *Urbana, Illinois* 61801 (AST76-20810)

A three-fold observational attack on important problems in understanding the physics and chemistry of diffuse interstellar clouds will be carried out. Further observations of the OH lambda 3078 interstellar line and searches for the NH lambda 3358 line will be made in order to test ion-molecule versus grain surface formation theory. Anomalously low Na (I) ratios have been measured toward four stars near the rho Oph dust cloud, which sug-

gests that enhanced depletion onto grains has taken place, in agreement with the larger-than-normal grains found in this region. Observations are planned of Na (I) K (I) ratios toward more reddened stars near this dust cloud and toward stars in other regions for which extinction data suggest large grains. The goal will be to achieve a better understanding of the process of element depletion onto grains from the interstellar gas. Radio observations of CO, OH, and H (I) toward OB stars will be made in order to study the spatial extent of diffuse clouds which produce optical absorption lines in the stellar spectra. One goal of these observations will be to study the relationship of the stars and the diffuse clouds of carbon monoxide. Mapping could show the velocity pattern predicted by dense expanding shell theory. Observations of carbon recombination lines toward stars with measured C (I) column densities are planned. This study will yield a direct measurement of the radiation field in the clouds. The result of the observations will be a better knowledge of molecular formation processes, grain formation, spatial extent, and possible evolution of diffuse clouds in the Galaxy.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0014, RADIO STUDIES OF PHYSICAL PROCESSES IN AND THE MOLECULAR COMPOSITION OF INTERSTELLAR CLOUDS, CIRCUMSTELLAR SHELLS, AND COMETS

L.E. SNYDER, Univ. of Illinois, School of Liberal Arts & Sci., *Urbana, Illinois* 61801 (AST77-01345)

A three-part program of molecular research on astronomical sources will be carried out. The first part will be an observational study of silicon oxide maser sources to determine how far they have evolved, how intense they are, and whether there are new, nearby, undiscovered maser sources. The second part will be observational tests of specific molecular formation mechanisms in the interstellar clouds which, in turn, may enhance our understanding of interstellar abundance ratios and chemical fractionation. The third part will include radio observations of molecules in comets in order to advance our limited understanding of cometary chemistry. The ultimate goal of this research is to understand the direction of galactic chemical evolution and its role in the various stages of star formation.

This action provides additional funding and extends the duration of the grant number AST76-04541 for 12 months.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0015, FEASIBILITY STUDY OF LIQUID POOL BURNING IN REDUCED GRAVITY

UNKNOWN, Univ. of Notre Dame, Graduate School, *Notre Dame, Indiana* 46556 (NAS 3-21018)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0016, FREQUENCY OF LATE-TYPE BINARY STARS

W.I. BEAVERS, Iowa State Univ. of Sc. & Tech, School of Hum. & Sciences, *Ames, Iowa* 50010 (AST76-10140 A01)

Renewal support is for a program of rapid, high-quality photoelectric radial velocity measurements using a Griffin-type mask. Under prior support in the eight-month interval of April 1976 through November 1976, approximately 1140 stellar radial velocity measurements have been obtained with the Fick Observatory 24-inch telescope and coude spectrograph. Such a dedicated instrument supplies valuable information concerning velocity variability and thus contributes significantly to a wide range of stellar subjects. The main objective is the determination of the frequency of binaries among nearby late-type dwarfs. Additional goals are the determination of radial velocity curves for numerous objects with previously suspected variability and definitive observations at crucial times for visual binary orbits. About 3000 additional measurements are expected to be obtained in the second year.

Prior support was by NSF grant AST76-10140.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0017, SPECTROSCOPIC STUDIES OF NOVA CYGNI 1975

A. SANYAL, Iowa State Univ. of Sc. & Tech, Graduate School, *Ames, Iowa* 50010 (AST76-18036)

An analysis of the spectrographic records of the Nova Cygni 1975 event will be made. The objective of the study will be the determination of the following physical conditions at various phases of the event: a) kinematics of the explosion, b) ionic composition, mass, and abundance of the ejected matter; c) electron temperature and electron densities of the shell; d) relative importance of ionization and recombination processes at various phases, and e) geometry of the ejected shells. Knowledge of these conditions should provide a coherent picture of the fastest and intrinsically brightest nova ever observed, and will promote a more fundamental understanding of the essential mechanisms of the nova process. A comparison of the properties of Nova Cygni as determined in this project with those of other novae will establish similarities and differences between this and other novae. Analysis of the spectrographic records of this event could provide an accurate determination of the abundance of a nova shell, and this can provide observational material to test theoretical hypothesis on the origin of the nova.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0018, SPECTROPHOTOMETRY OF BINARY STARS

J.D. FIX, Univ. of Iowa, School of Liberal Arts, *Iowa City, Iowa* 52240 (AST77-08942)

There are several classes of binary star systems which have peculiar energy distributions in the sense that the light is not a combination of the light of two normal stars. This research will be devoted to observations of such systems. Observations of these stars will be made in both the visible and infrared regions of the spectrum in order to determine physical parameters of the circumstellar gas such as temperature, geometry of the emitting regions, and mass exchange rates.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0019, RESEARCH IN STELLAR CHROMOSPHERES WITH THE COPERNICUS SATELLITE

H.W. MOOS, Johns Hopkins University, School of Arts & Sciences, *Baltimore, Maryland* 21218 (NSG 5184)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0020, NAVIGATION - TWO-COLOR REFRACTOMETER

D.G. CURRIE, Univ. of Maryland, School of Arts & Sciences, *College Park, Maryland* 20742 (DN775533; N00014-77-C-0541)

The objective of this work unit is to develop a new astronomical technique which will directly measure the effects of the atmosphere on the apparent positions of stars, thereby allowing the determination of stellar positions with an accuracy significantly better than 0.1 arc-second in a single observation which is of interest to the Navy for improved navigation and guidance.

This experiment involves the measurement of the apparent position of a star at two widely separated wavelengths, thereby permitting one to use the difference in apparent position to determine the total effect of the atmosphere on the apparent position of stars. Data will be taken under a variety of atmospheric conditions and locations. The validity of this approach will be determined by examining the internal consistency of the data as well as comparison with the results of other measurements where atmospheric effects have been corrected in other ways.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense, Navy

10.0021, ANALYSIS OF ORBITAL AND CELESTIAL ENVIRONMENT DISPLAY INFORMATION
A. ROSENFELD, Univ. of Maryland, School of Engineering, *College Park, Maryland* 20740 (NCA 5-22)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0022, STUDIES OF CHROMOSPHERES AND CORONA OF LATE-TYPE STARS/REOBSERVATION OF ALPHA AURIGAE
A.K. DUPREE, Harvard University, School of Arts & Sciences, *Cambridge, Massachusetts* 02138 (NSG 5191)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0023, PIONEER VENUS DATA ANALYSIS
UNKNOWN, Mass. Inst. of Technology, Graduate School, *Cambridge, Massachusetts* 02139 (NAS 2-9476)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0024, ASTRONOMICAL RESEARCH IN PROPER MOTIONS
W.J. LUYTEN, Univ. of Minnesota, Space Science Center, *Minneapolis, Minnesota* 55455 (AST77-13847)

This award supports the continuation and completion of a general catalog of proper-motion stars over the whole sky with angular motions equal to or greater than 0.5 seconds of arc per year. These data are being assembled from researches of the Principal Investigator and all published sources. The main activity will be the preparation of finding charts to assist would-be observers of these approximately 4000 large proper-motion stars for investigations of other parameters of astrophysical interest. Assistance in this work will be furnished by Dr. Henry Albers with support by a companion grant. Additional attention will be given to the completion of the provisional catalog, already assembled, including the correction of entries where necessary. Support is included for the publication of the catalog and finding charts in an astronomical periodical, for wide dissemination of this important information on the stars of the solar neighborhood.

Prior support was by NSF grant AST73-05241 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0025, LABORATORY AND OBSERVATIONAL SPECTROSCOPIC STUDIES OF MOLECULES AND PROCESSES OF ASTROPHYSICAL INTEREST
W.H. SMITH, Washington University, School of Arts & Sciences, *St. Louis, Missouri* 63130 (AST77-06050)

A vigorous research program in laboratory and observational astrophysics which had previously been carried out as part of the laboratory astrophysics program at Princeton will be continued at Washington University. A considerable fraction of the absolute transition probability data for molecules and atoms in their allowed electronic transitions which is presently in use by astronomers was done earlier at Princeton. The laboratory and observational research is now being established at Washington University. The transition probability measurement program will continue. The major efforts of the new program will, however, be through photo-acoustic methods of spectroscopy using a tunable dye laser. Observational studies of diffuse matter in space using a Fabry-Perot interferometer will be carried out.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0026, INTERFEROMETRIC SPECTRAL OBSERVATIONS OF THE INTERSTELLAR MEDIUM IN THE NEAR ULTRAVIOLET WITH THE SPIFI
W.H. SMITH, Washington University, Graduate School, *St. Louis, Missouri* 63130 (NSG 7372)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0027, COPERNICUS OBSERVATIONS FOR DETERMINATIONS OF ABUNDANCE OF RATIOS
W.H. SMITH, Washington University, Graduate School, *St. Louis, Missouri* 63130 (NSG 5187)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0028, A THEORETICAL STUDY OF DOUBLE-MODE CEPHEIDS
N.R. SIMON, Univ. of Nebraska, School of Arts & Sciences, *Lincoln, Nebraska* 68508 (AST77-10155)

The Cepheid variables are a group of very luminous supergiant stars which undergo regular changes in luminosity. Modern astrophysical theory has interpreted these changes as being due to a change in the size of the star in a regular periodic fashion. Most of these stars behave in a manner which indicates that a single period can be assigned to the observed variability of the star. In some instances, however, there is clear evidence that several frequencies of oscillation are present in the star. This project will be directed towards a theoretical discussion of this phenomenon. The theoretical results will then be compared with observations of these objects.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0029, DOCUMENTATION OF THE REVOLUTION IN ASTROPHYSICS AND A HISTORY OF CONTEMPORARY COSMOLOGY
S. WEART, Amer. Inst. of Physics Inc., *New York, New York* 10017 (SOC76-03434 A01)

The American Institute of Physics Center for History of Physics is surveying the history of recent astrophysics in order to assemble documentation valuable to present and future historians. Correspondence and other documents are being uncovered and preserved in appropriate repositories, and in some cases microfilmed and cataloged. Oral history interviews are supplementing the written record. Meanwhile, a focussed study of the recent history of a subfield, cosmology, is helping to guide the general survey. The entire twentieth century is being covered with emphasis on post-World War II developments and with close attention to the scientific revolution currently in progress.

SUPPORTED BY U.S. National Science Foundation, Div. of Social Sciences

10.0030, SIMULTANEOUS X-RAY PHOTOMETRIC AND POLARIMETRIC OBSERVATIONS OF THE CYGNUS FIELD
R. NOVICK, Columbia University, School of Arts & Sciences, *New York, New York* 10027 (NSG 5194)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0031, SOUNDING ROCKET-BORNE X-RAY RESEARCH OF TEMPORAL AND SPECTRAL FEATURES
R. NOVICK, Columbia University, School of Arts & Sciences, *New York, New York* 10027 (NSG 5200)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0032, COMPUTATIONAL METHODS IN STELLAR EVOLUTION
R.L. SMITH, Rensselaer Polytechnic Inst., School of Science, *Troy, New York* 12181 (AST76-21314)

The method of collocation will be applied to the problem of the numerical computation of stellar evolutionary model sequences. In this method the dependent variables are expanded as polynomials of low order with the coefficients chosen to satisfy the stellar structure equations at selected collocation points. It is felt that such a scheme should reduce the amount of computer time needed to compute stellar models. A stellar evolution computer program based on this collocation method will be constructed and its performance will be tested on the main sequence and early post main sequence phases.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0033, STUDIES IN GENERAL RELATIVITY THEORY
F.P. ESPOSITO, Univ. of Cincinnati, School of Arts & Sciences, *Cincinnati, Ohio* 45221 (INT75-18457 A02)

This award is being given jointly by NSF and the Venezuelan Government to enable Drs. F. Paul Esposito and Louis Witten of the University of Cincinnati to carry on a cooperative research program in 'Studies in General Relativity Theory' with their Venezuelan colleague, Dr. Louis Herrera, of the Universidad Central de Venezuela.

Their studies of the properties of exact solutions of Einstein's General Relativity Equations and of the behavior of perfectly conducting fluids in strong magnetic and gravitational fields are important for the further development of black hole theory and have astrophysical applications in the understanding of stellar collapse.

This award is a renewal of a previous one given to these researchers on the same subject.

SUPPORTED BY U.S. National Science Foundation, Div. of International Programs

10.0034, RESEARCH OF THE TEMPORAL LINE-BLANKETING EFFECTS FOR PHOTOMETRIC VARIATIONS
M.R. MOLNAR, Univ. of Toledo, School of Arts & Sciences, *Toledo, Ohio* 43606 (NSG 5183)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0035, RESEARCH INITIATION FOR MINORITY INSTITUTION IMPROVEMENT - PULSAR FLUX VARIATIONS
G.A. ZEISSIG, Univ. of Puerto Rico, School of Natural Sciences, *San Juan, Puerto Rico* 00931 (SER77-04602)

The primary objective of this work will be a determination of how the radio flux density of approximately forty pulsars varies over long periods of time. The flux data will be examined for periodic variations. Simultaneous observations will be made at two radio frequencies in order to determine whether random variations observed in the radio flux are propagation effects or properties intrinsic to the pulsar emission mechanism. The results will be of value in the study of pulsar dynamics and in the selection of a realistic pulsar model.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0036, OBSERVATIONS OF GALACTIC NUCLEI
D.W. WEEDMAN, Vanderbilt University, School of Arts & Sciences, *Nashville, Tennessee* 37232 (AST75-16326 A01)

The quasi-stellar objects (QSOs) are thought to be extremely luminous nuclei of galaxies, especially resembling the Seyfert galaxies. These objects will be studied by discovering new QSOs with optical techniques and observing them by both optical and radio techniques. This will allow a description of how the number and properties of QSOs change as their redshifts increase, which should lead to a better description of conditions in the early universe. The nuclei of numerous nearby galaxies will also be studied photographically and photometrically in an attempt to define the range of activity in such nuclei. In particular, attempts will be made to study galaxies whose very compact nuclei resemble the hypothesized predecessors of Seyfert galaxy nuclei.

This is a continuation of work previously supported by NSF grant AST75-16326.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0037, RELATIVITY AND RELATED THEORIES
C. DEWITT, Univ. of Texas, School of Natural Sciences, *Austin, Texas* 78712 (PHY77-07619)

Topics in gravitation theory and its applications will be initiated. Particular topics to be investigated include:

De Witt-Morette: 1. Nonrelativistic path integrals on curved space: a. Lagrangian formulation; b. Hamiltonian formulation; 2. Relativistic path integrals; a. Classical models; b. Quantum properties.

Matzner: 1. Entropy production near the big bang; 2. Scattering of radiation by black holes.

Shepley: 1. Spinor fields in cosmological models; 2. Mathematical structure of space-time.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

10.0038, ANALYSIS OF DATA FROM THE MAGNETOSPHERE AND SOLAR WIND
A.J. DESSLER, Rice University, Graduate School, *Houston, Texas* 77001 (ATM77-12619)

This grant will support an investigation of a limited number of specific, well-defined questions relating to the physics of the earth's magnetosphere, through an extensive and coordinated program of theoretical development and analysis of data from a variety of past and present satellite and ground-based experiments. This program will involve a large measure of cooperation among several American and European scientific institutions and will contribute in a significant way towards the overall objectives of the International Magnetospheric Study (IMS).

The research is directed towards answering the following three fundamental questions: (1) How does the solar wind control the electric potential drop across the polar cap that drives magnetospheric convection; (2) What mechanisms are responsible for the injection and acceleration of solar-wind plasma at the magnetopause; and (3) What are the relationships among magnetospheric convection patterns, auroral morphology, particle precipitation patterns, and field-aligned currents.

Theoretical research on the above topics has advanced to a stage where several significant observational tests are necessary and feasible. Several other crucial tests will become feasible during the period of the IMS, given a modest level of effort in refining and applying existing theory. The intent is to provide a balanced program of coordinated data analysis and theoretical development that will complement and enhance the data-acquisition programs of the IMS.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0039, SPIRAL STRUCTURE, BAR STRUCTURE, AND LARGE-SCALE GAS DYNAMICS IN GALAXIES
W.W. ROBERTS, Univ. of Virginia, School of Arts & Sciences, *Charlottesville, Virginia* 22903 (AST72-05124 A04)

The spiral structure, bar structure and large-scale gas dynamics in galaxies will be investigated. A hydrodynamic code will be developed that will determine the steady-state gas flow in barred spirals, including the bar structure itself. A detailed theoretical simulation of normal spiral galaxies will be possible also via this code. Relationships among a number of the structural and morphological parameters, including the observed neutral hydrogen field, the radio continuum, the observed velocity field, colors and optical luminosities, will be incorporated. Procedures of reduction to be applied to the theoretical results will be developed so that the effects of the reduction procedures used for observational data can be simulated. The work is important since

the interstellar gas through its dynamics and large-scale motion and distribution plays an important governing role in star formation, in the degree of development of spiral structure, and in the overall optical appearance of galaxies.

This action provides additional funding and extends the duration of the grant number AST72-05124 A03 for 12 months.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0040, STUDIES OF THE INTERPLANETARY PARTICULATE ENVIRONMENT
S.F. SINGER, Univ. of Virginia, School of Arts & Sciences, *Charlottesville, Virginia* 22903 (NSG 1427)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0041, A SOURCE OF INTERSTELLAR ABUNDANCES/ULTRAVIOLET STUDIES OF THE INTERSTELLAR MEDIUM, HOT STARS AND COSMIC X-RAY SOURCES
B.D. SAVAGE, Univ. of Wisconsin, School of Letters & Science, *Madison, Wisconsin* 53706 (NSG 5181)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0042, GRAVITY, QUANTIZED FIELDS, AND RELATIVISTIC ASTROPHYSICS
L. PARKER, Univ. of Wisconsin, School of Letters & Science, *Milwaukee, Wisconsin* 53221 (PHY77-07111)

Research initiated under NSF Grant PHY72-05161 A02 will be continued. In addition to the areas of research under the previous grant, new topics in relativistic astrophysics will be investigated. John Friedman, who has recently joined the university as an Assistant Professor, is included in the present project as co-investigator.

Research under way on vacuum polarization and particle creation by strong gravitational fields will continue. Work on the quantum treatment of the damping of expansion anisotrophy in the early universe will be generalized and extended. A new type of infrared divergence occurring for quantized gravitational and scalar fields will be investigated. Other topics in quantum field theory on curved backgrounds will also be studied.

Research on the analogue for curved space-time of the Dirac charge quantization condition will be continued. A related area of research involves quantizing test electromagnetic fields on curved space-times with non-trivial topologies. The possible existence of spinor fields acted on by the group of diffeomorphisms on a space-time will also be investigated.

In recent work, John Friedman showed that all rotating Newtonian stars are unstable or marginally unstable to gravitational radiation; a key aim of his current research is to establish analogous results in general relativity.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

10.0043, INFRARED STUDIES OF INTERSTELLAR AND CIRCUMSTELLAR MATERIALS
J.A. HACKWELL, Univ. of Wyoming, School of Arts & Sciences, *Laramie, Wyoming* 82071 (AST77-07505)

The composition and distribution of dust in space and the effect on the dust of its environment, for example, the radiation field, the gas density and the degree of ionization, will be studied using infared astronomy techniques. The goal is to determine to what extent the dust observed in ionized hydrogen (HII) regions, in 'cold' interstellar space, and around late-type stars is related.

Dust in HII regions will be studied by making maps in the 8-13 micron and 16-25 micron spectral regions using array spectrometer systems developed at Wyoming and mounted on the University of Wyoming's 2.3-meter (92 inch) infrared telescope. Infrared line observations of HII regions will be made, particularly in heavily observed regions, to determine excitation conditions in the nebula. An Indium-Antimonide (InSb) system will be used to make sensitive 1-5 micron observations of line strengths and free-free emission in selected regions. The observations of dust in HII regions will be compared with measurements of infrared interstellar absorption bands and with spectral features observed in late-type stars and other heavily obscured objects.

The scheduling flexibility of the 2.3-m telescope will allow the study of dust formation is such transient events as novae when they occur. These studies will help us to understand dust formation mechanisms in other objects.

This is a continuation of work previously supported by NSF grant AST75-09875.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

GENERAL

11.0001, OPERATION OF A STATE TECHNOLOGY APPLICATION CENTER
UNKNOWN, State University of Fla. Sys., Graduate School, *Tallahassee, Florida* 32306 (NASW 3060)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N78-12998*+ National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 88
Oct. 1977 110 p
(NASA-SP-7037(88)) Avail: NTIS E02 CSCL 01A

This bibliography lists 368 reports, articles, and other documents introduced into the NASA scientific and technical information system in September 1977. Author

N78-12999*# Texas A&M Univ., College Station. Flight Mechanics Lab.
AGRICULTURAL AVIATION RESEARCH
Howard L. Chevalier, comp. and Louis F. Bouse, comp. (Agricultural Research Service, College Station, Tex.) 1977 151 p Proc. of Workshop held at College Station, Tex., 19-21 Oct. 1976
(NASA Order L-49862-A)
(NASA-CP-2025) Avail: NTIS HC A08/MF A01 CSCL 01C

A compilation of papers, comments, and results is provided during a workshop session. The purpose of the workshop was to review and evaluate the current state of the art of agricultural aviation, to identify and rank potentially productive short and long range research and development areas, and to strengthen communications between research scientists and engineers involved in agricultural research. Approximately 71 individuals actively engaged in agricultural aviation research were invited to participate in the workshop. These were persons familiar with problems related to agricultural aviation and processing expertise which are of value for identifying and proposing beneficial research. Author

N78-13000# General Dynamics/Convair, San Diego, Calif. Aerospace Div.
F-106 SCHEDULED MAINTENANCE STUDY. PHASE 3: PREDICTIONS AND RECOMMENDATIONS Final Report
L. J. Brown, K. E. Marks, Gordon Wang, R. S. Grote, and J. R. Cooper Sep. 1972 345 p
(Contract F41608-71-D-1383)
(AD-A045399; GDCA-AHD72-005) Avail: NTIS HC A15/MF A01 CSCL 01/3

The objective of the F-106 Scheduled Maintenance Study was to formulate a method for examining the scheduled maintenance program in terms of both inspection content and interval suitable for any aircraft and to optimize that maintenance program on a cost and effectiveness basis. Data review, data bank generation, field trips, and problem formulation were accomplished in Phase I of the study, as reported in GDCA-AHD72-001. During Phase II of this study, as reported in GDCA-AHD72-003, the required statistical analyses were programmed and performed; the maintenance program analysis process was formulated; the cost and effectiveness models were formulated, programmed, and exercised; and a preliminary definition of the alternative maintenance program was completed. This report documents the results of the third and final phase of the study as well as Phase I and II. The tasks included in Phase III were the definition of the alternative maintenance program inspection packages and interval constraints, optimization of the maintenance program interval through cost and effectiveness analysis, formulation of a transition strategy for the recommended maintenance program, and preparation of a user's manual for the software package developed during the study. GRA

N78-13001# General Dynamics/Convair, San Diego, Calif. Aerospace Div.
F-106 SCHEDULED MAINTENANCE STUDY. USER'S MANUAL
Gordon Wang, R. S. Grote, and J. R. Cooper Sep. 1972 519 p
(Contract F41608-71-D-1383)
(AD-A045625; GDCA-AHD72-006) Avail: NTIS MF A01 CSCL 01/3

A system of IBM 370 programs has been developed for the scheduled maintenance study by Convair Aerospace Division of General Dynamics for the San Antonio Air Materiel Area, Kelly AFB, Texas. This handbook provides information needed by user personnel for basic understanding and for executing each of the computer programs. A fleet of 150 F-106 aircraft was used to validate the design of the programs on the IBM 370 (Model 165) at Convair Aerospace, San Diego. The design of the programs is generalized to cover all USAF aircraft. GRA

N78-13002# General Dynamics/Convair, San Diego, Calif. Aerospace Div.
F-106 SCHEDULED MAINTENANCE IMPROVEMENT SUMMARY
Nov. 1972 13 p
(Contract F41608-71-D-1383)
(AD-A045400; GDCA-AHD72-008) Avail: NTIS HC A02/MF A01 CSCL 01/3

The primary objective was to provide an improved scheduled maintenance program for the F-106 that will reduce weapon system operating costs without adversely affecting aircraft safety and reliability. The second objective was to provide the methodology used to perform the F-106 study in a format suitable for usage on other Air Force aircraft. Convair successfully accomplished both of these objectives. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N78-13003 Purdue Univ., Lafayette, Ind.
FINITE ELEMENT FLUTTER ANALYSIS OF FLAT PANELS IN THREE-DIMENSIONAL SUPERSONIC UNSTEADY POTENTIAL FLOW Ph.D. Thesis

Shung-Hsing Sung 1976 152 p
Avail: Univ. Microfilms Order No. 77-15480

A finite element formulation and procedure was developed for predicting flutter boundaries for rectangular panels with finite aspect ratio and with one surface exposed to a supersonic potential flow. The aerodynamic matrix was formulated by using the principle of virtual work. The perturbation pressures or velocity potentials that produce the work or energy were obtained by using the so called box method on the basis of three dimensional linearized supersonic unsteady potential flow theory. In the application of box method, each finite element is divided into a number of boxes. The aerodynamic influence coefficients relating the velocity potential of any receiving box to the sending box are found through numerical integration. The aerodynamic matrix is subsequently found also by numerical integration.

Dissert. Abstr.

N78-13004 Rutgers Univ., New Brunswick, N. J.
THE TURBULENT NEAR-WAKE OF AN ANNULAR STEP AT SUBSONIC SPEEDS Ph.D. Thesis
Sachidananda Kangovi 1977 142 p
Avail: Univ. Microfilms Order No. 77-17543

Annular step models of 1/4 in, 1/2 in, 3/4 in, and 1 in were tested in the Mach number range of 0.9 to 0.95 and in Reynolds number range of 900,000 to 6.2 million/ft. Analyses of the measurements taken indicate that the upstream influence distance depends on Mach number, approaching boundary layer and step height. The base pressure coefficient was found to be constant for Mach numbers between 0.1 and 0.8 and then dropped sharply at near sonic speeds. The experimental value of the recovery pressure agreed reasonably with the theoretical prediction of one dimensional analysis of sudden expansion, but at Mach numbers greater than 0.4, the experimental results showed a departure from the theory. The reattachment point was located at a distance of about eight times the step height downstream of the step. The secondary separation point was within a distance of one step height downstream of the step. Dissert. Abstr.

N78-13005 Tennessee Univ., Knoxville.
ACOUSTIC INVESTIGATION OF UPPER SURFACE BLOWN FLAPS Ph.D. Thesis
Mahendrakumar C. Joshi 1977 209 p
Avail: Univ. Microfilms Order No. 77-16586

An upper surface blown flap was modeled by a slot nozzle exhausting over a plane flap and measurements were made in the free field and in a reverberation room. Flap length, flap deflection angle, nozzle aspect ratio and the jet exit Mach number were varied. Shadowgraph stills and movies were obtained for flow visualization and limited turbulence measurements were made using hot film anemometry. Flap surface pressure fluctuations were spectrum analyzed and cross-correlated with the far-field sound. Cross-correlations of the surface pressure fluctuations with the far-field sound showed the flap trailing edge to be a major noise source region, but the dominant noise mechanisms depend on the flap length. Dissert. Abstr.

N78-13006 Tennessee Univ., Knoxville.
A STUDY OF THE AERODYNAMIC DESIGN OF VISCOUS NOZZLES USED TO ACCELERATE LARGE PARTICLES TO HIGH VELOCITY Ph.D. Thesis
Philip Alfred Kessel 1977 142 p
Avail: Univ. Microfilms Order No. 77-16589

Slender channel approximation was used to reduce the governing equations for compressible subsonic and supersonic flow to a set of parabolic equations. The Prandtl mixing length model was modified to account for the change in mixing length distribution that occurs when the boundary layers of the acceleration nozzle wall merge. Equations for the velocity and temperature history of a particle on the centerline of a particle acceleration nozzle were developed and solved as well as those for two dimensional particle flows. The particle trajectories are shown to be very sensitive to the injection chamber design. Performance benefits were realized by optimizing the contour of the acceleration nozzle. The resulting contour produces higher particle velocities but has flow variable distributions that are very different from the more conventional conical nozzle.

Dissert. Abstr.

N78-13007*# Aerospace Systems, Inc., Burlington, Mass.
AERODYNAMIC INTERFERENCE EFFECTS ON TILTING PROPROTOR AIRCRAFT Final Technical Report, Oct. 1975 - May 1977
Paul Soohoo, Luigi Morino (Boston Univ.), Richard B. Noll, and Norman D. Ham (MIT, Cambridge) Jun. 1977 141 p refs
(Contract NAS2-8671)
(NASA-CR-152053; ASI-TR-76-28) Avail: NTIS HC A07/MF A01 CSCL 01A

The Green's function method was used to study tilting proprotor aircraft aerodynamics with particular application to the problem of the mutual interference of the wing-fuselage-tail-rotor wake configuration. While the formulation is valid for fully unsteady rotor aerodynamics, attention was directed to steady state aerodynamics, which was achieved by replacing the rotor with the actuator disk approximation. The use of an actuator disk analysis introduced a mathematical singularity into the formulation; this problem was studied and resolved. The pressure distribution, lift, and pitching moment were obtained for an XV-15 wing-fuselage-tail rotor configuration at various flight conditions. For the flight configurations explored, the effects of the rotor wake interference on the XV-15 tilt rotor aircraft yielded a reduction in the total lift and an increase in the nose-down pitching moment. This method provides an analytical capability that is simple to apply and can be used to investigate fuselage-tail rotor wake interference as well as to explore other rotor design problem areas. A.H.

N78-13008*# Lockheed Missiles and Space Co., Huntsville, Ala.
GROUND SIMULATION AND TUNNEL BLOCKAGE FOR A SWEPT, JET-FLAPPED WING TESTED TO VERY HIGH LIFT COEFFICIENTS
J. E. Hackett and R. A. Boles Jun. 1977 159 p refs
(Contract NAS2-9155)
(NASA-CR-152032) Avail: NTIS HC A08/MF A01 CSCL 01A

Ground effects experiments and large/small tunnel interference studies were carried out on a model with a 20 inch (50.8 cm) 25 degree swept wing. The wing is slatted, has a 60 degree knee-blown flap and can be fitted with unflapped tips. A tail rake of pitch-yaw probes can be fitted to the fuselage. Certain check tests were also made with a very similar straight-wing model. Author

N78-13009*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
COMPUTATIONS OF SUPERSONIC VISCOUS FLOW OVER A FINITE-WIDTH PLATE
C. P. Li Aug. 1977 45 p refs
(Contract NAS9-15200)
(NASA-CR-151534; JSC-13140; TR-7004) Avail: NTIS HC A03/MF A01 CSCL 01A

Finite difference methods were applied to solve the parabolic Navier-Stokes equations for the flow over a finite width plate at 0 deg and 10 deg angles of attack. The methods were developed on the basis of the operator factorization concept resulting in the split of a three dimensional equation into successive two dimensional equations. Backward and centered implicit factorization schemes, were used and their results were compared. Available numerical solutions and experimental data obtained at low Reynolds number conditions were also used for comparison. The backward implicit method provides a more successful solution, which ranges from the merged layer to the strong interaction regimes. Detailed structures were revealed of the shear layer around and behind the side edge. Author

N78-13010*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUBSONIC LONGITUDINAL AND LATERAL DIRECTIONAL STATIC STABILITY CHARACTERISTICS OF A VARIABLE SWEEP FIGHTER CONFIGURATION EMPLOYING VARIOUS CONTROL SURFACE DEFLECTIONS AT ANGLES OF ATTACK OF 0 DEG TO 50 DEG AND LARGE SIDESLIP ANGLES
Jarrett K. Huffman, Charles H. Fox, Jr., and Sue B. Grafton Nov. 1977 235 p refs
(NASA-TM-74050) Avail: NTIS HC A11/MF A01 CSCL 01A

A variable sweep fighter configuration with the wing in the 22 deg sweep position having leading edge slats and trailing edge flaps on the outboard panels was tested at a Mach number of 0.15 in the Langley 7- by 10-foot high speed tunnel. The angle of attack range was 0 deg to 50 deg and the sideslip angle range was -20 deg to 20 deg. Pitch, roll, and yaw control effectiveness were studied as well as the effects of spoilers. The data are presented without analysis. GRA

N78-13011*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AERODYNAMIC CHARACTERISTICS OF AIRPLANES AT HIGH ANGLES OF ATTACK

Joseph R. Chambers and Sue B. Grafton Dec. 1977 95 p refs Presented at AGARD/VKI Lecture Series on Aerodynamic Inputs for Problems in Aircraft Dynamics, Rhode-St-Genese, Belgium, 25-29 Apr. 1977

(NASA-TM-74097; L-11695) Avail: NTIS HC A05/MF A01 CSCL 01A

An introduction to, and a broad overiew of, the aerodynamic characteristics of airplanes at high angles of attack are provided. Items include: (1) some important fundamental phenomena which determine the aerodynamic characteristics of airplanes at high angles of attack; (2) static and dynamic aerodynamic characteristics near the stall; (3) aerodynamics of the spin; (4) test techniques used in stall/spin studies; (5) applications of aerodynamic data to problems in flight dynamics in the stall/spin area; and (6) the outlook for future research in the area. Although stalling and spinning are flight dynamic problems of importance to all aircraft, including general aviation aircraft, commercial transports, and military airplanes, emphasis is placed on military configurations and the principle aerodynamic factors which influence the stability and control of such vehicles at high angles of attack. Author

N78-13012*# Kansas Univ., Lawrence.

INVESTIGATION OF COMPRESSIBLE VORTEX FLOW CHARACTERISTICS Final Report

Vincent U. Muirhead Nov. 1977 95 p refs

(Contract NAS1-12976)

(NASA-CR-145261; CRINC-FRL-260-1) Avail: NTIS HC A05/MF A01 CSCL 01A

The nature of intense air vortices was studied and the factors which determine the intensity and rate of decay of both single and pairs of vortices were investigated. Vortex parameters of axial pressure differential, circulation, outflow rates, separation distance and directions of rotation were varied. Unconfined vortices, generated by a single rotating cage, were intensified by an increasing axial pressure gradient. Breakdown occurred when the axial gradient became negligible. The core radius was a function of the axial gradient. Dual vortices, generated by two counterrotating cages, rotated opposite to the attached cages. With minimum spacing only one vortex was formed which rotated in a direction opposite to the attached cage. When one cage rotated at half the speed of the other cage, one vortex formed at the higher speed cage rotating in the cage direction. Author

N78-13013# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.

THE EVALUATION OF THE VORTEX ROLL-UP OVER AND BEHIND WINGS RELATED TO THEIR NON-LINEAR AERODYNAMIC CHARACTERISTICS Ph.D. Thesis

C. Zorea and J. Rom 24 Feb. 1977 60 p refs Backup document for AIAA Synoptic, "Vortex Roll-Up Over and Behind Wings Related to Nonlinear Aerodynamic Characteristics", scheduled for publication in Journal of Aircraft in Mar. 1978

(Grant AF-AFOSR-2145-71)

Avail: NTIS HC A04/MF A01

The rolling up of vortices over and behind wings of rectangular and delta planforms is studied by evaluating the loading of these wings. Vortex distribution over the planform is represented by a vortex lattice system incorporating in this calculation the influence of the vortices shed from these cells into the flow field. The evaluation of the diameter of the vortices far downstream of the wing, of the spanwise position of the center of this vortex, and the appearance of secondary vortices all are in reasonable agreement with experimental results. Author

N78-13014*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EFFECTS OF DEFLECTED THRUST ON THE LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF A CLOSE-COUPLED WING-CANARD CONFIGURATION

Long P. Yip and John W. Paulson, Jr. Dec. 1977 88 p refs (NASA-TP-1090; L-11886) Avail: NTIS HC A05/MF A01 CSCL 01A

The effects of power on the longitudinal aerodynamic characteristics of a close-coupled wing-canard fighter configuration with partial-span rectangular nozzles at the trailing edge of the wing were investigated. Data were obtained on a basic wing-strake configuration for nozzle and flap deflections from 0 deg to 30 deg and for nominal thrust coefficients from 0 to 0.30. The model was tested over an angle-of-attack range from -2 deg to 40 deg at Mach numbers of 0.15 and 0.18. Results show substantial improvements in lift-curve slope, in maximum lift, and in drag-due-to-lift efficiency when the canard and strakes have been added to the basic wing-fuselage (wing-alone) configuration. Addition of power increased both lift-curve slope and maximum lift, improved longitudinal stability, and reduced drag due to lift on both the wing-canard and wing-canard-strake configurations. These beneficial effects are primarily derived from boundary-layer control due to moderate thrust coefficients which delay flow separation on the nozzle and inboard portion of the wing flaps. Author

N78-13015*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

THEORETICAL AND EXPERIMENTAL ANALYSIS OF LONGITUDINAL AND LATERAL AERODYNAMIC CHARACTERISTICS OF SKEWED WINGS AT SUBSONIC SPEEDS TO HIGH ANGLES OF ATTACK

James M. Luckring Washington Dec. 1977 98 p refs (NASA-TN-D-8512; L-11230) Avail: NTIS HC A05/MF A01 CSCL 01A

The effects of sweep and aspect ratio on the longitudinal and lateral-directional aerodynamic characteristics of low-aspect-ratio skewed (oblique) wings having separation-induced vortex flows along leading and side edges were investigated in the Langley high-speed 7- by 10-foot tunnel at a low-subsonic Mach number. The theoretical analysis used the vortex-lattice method for estimating attached-flow aerodynamic characteristics and the leading-edge suction analogy of Polhamus for estimating separation induced vortex-flow effects. Experimental results were compared with asymmetric, separated, vortex flow theory. Author

N78-13016*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EFFECTS OF ROUGHNESS SIZE ON THE POSITION OF BOUNDARY-LAYER TRANSITION AND ON THE AERODYNAMIC CHARACTERISTICS OF A 55 DEG. SWEPT DELTA WING AT SUPERSONIC SPEEDS

Robert L. Stallings, Jr. and Milton Lamb Dec. 1977 49 p refs

(NASA-TP-1027; L-11496) Avail: NTIS HC A03/MF A01 CSCL 01A

An experimental investigation was conducted to determine the effects of roughness size on the position of boundary layer transition and on the aerodynamic characteristics of a 55 deg swept delta wing model. Results are presented and discussed for wind tunnel tests conducted at free stream Mach numbers from 1.50 to 4.63, Reynolds numbers per meter from 3,300,000 to 1.6 x 10 to the 7th power, angles of attack from -8 to 16 deg, and roughness sizes ranging from 0.027 cm sand grit to 0.127 cm high cylinders. Comparisons were made with existing flat plate data. An approximate method was derived for predicting the drag of roughness elements used in boundary layer trips. Author

N78-13017*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

COMPUTATION OF TRANSONIC BOATTAIL FLOW WITH SEPARATION

Richard G. Wilmoth Dec. 1977 65 p refs

(NASA-TP-1070; L-11669) Avail: NTIS HC A04/MF A01 CSCL 01A

The relaxation procedure of South and Jameson for the full potential transonic flow equation was coupled to a modified Reshotko-Tucker integral boundary-layer technique with an empirical model for separated flow. The viscous and inviscid flows were solved iteratively until convergence was obtained. This iterative method was then applied to the subsonic and transonic flow over a series of axisymmetric circular-arc boattails with solid jet plume simulators. Comparisons of theoretical and experimental surface pressures and boattail drag are presented over a free-stream Mach number range of 0.40 to 0.96. Measured and predicted pressures agree well for Mach numbers below 0.90. boattail angle well into the region of transonic drag rise was correctly predicted; however, the absolute drag levels were significantly underpredicted. For separated flows, the empirical discriminating streamline model gives good results up to a free-stream Mach number of about 0.90 and allows reasonable predictions for shock-induced separation if the proper separation location and separation turning angle are known. Author

N78-13018# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.

USER'S GUIDE TO COMPUTER PROGRAM FOR ESTIMATING AIRPLANE LOCAL FLOW FIELD DUE TO WING-BODY EFFECTS

J. B. Smith 1 Apr. 1977 20 p refs
(AD-A045621; NADC-76346-30) Avail: NTIS HC A02/MF A01 CSCL 20/4

This report describes a computer program, and its use, which has been written to determine, using a relatively simple model, the local flow field about an airplane due to wing-body effects. The program includes compressibility effects up to the critical Mach number. It takes as inputs various geometric parameters and the flight condition (in terms of Mach number, lift coefficient, and angle of attack). Author (GRA)

N78-13019# Martin Marietta Labs., Baltimore, Md.

BOUNDARY LAYER OVER SPINNING BLUNT-BODY OF REVOLUTION AT INCIDENCE AND MAGNUS FORCES

K. C. Wang Aug. 1977 90 p refs
(Contracts DAHC04-73-C-0011; F49620-76-C-0004)
(AD-A045535; MML-TR-77-50C) Avail: NTIS HC A05/MF A01 CSCL 20/4

An incompressible laminar flow over a spinning blunt-body at incidence is investigated. The approach follows strictly the three-dimensional boundary layer theory, and the lack of initial profiles is readily resolved. The rule of the dependence zone is satisfied with the Krause scheme and complete numerical solutions are obtained for an ellipsoid of revolution at 6 deg incidences and two different spin rates. Spinning causes asymmetry which, in turn, introduces the Magnus force. The asymmetry is most pronounced in crossflow, but is also noticeable in the skin-friction and displacement thickness of the meridional flow. A variety of crossflow profiles are determined as are the streamline patterns in the cross- and meridional-planes which are especially useful in visualizing the flow structure. The Magnus forces due to the crossflow skin friction and the centrifugal pressure are determined; these two forces partly compensate each other. At lower spin rage, the frictional force is larger, resulting in a positive Magnus force. At high spin rate, the opposite is obtained. At high incidence (30 deg), the leeside separated region associated with an open separation is found not amenable to a classical boundary layer treatment. The present boundary layer calculations could be carried out, in the longitudinal direction, only up to the beginning of an open separation. Since an open separation moves forward with increasing incidence, the calculable area, therefore, decreases. GRA

N78-13020# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INVESTIGATION OF VELOCITY FIELD BEHIND LOW-FLYING WING WITH FUSELAGE

M. K. Bochin and L. G. Tsvetkov 11 May 1977 22 p refs Transl. into ENGLISH from Tr. Leningrad. Korablestroitelnogo Inst. (Leningrad), v. 69, 1970 p 11-17
(AD-A045073; FTD-ID(RS)I-0531-77) Avail: NTIS MF A01 CSCL 20/4

This article proposes a method for investigation of the velocity field behind a low-flying wing with fuselage. The value of the velocity field is necessary in calculating the aerodynamic characteristics of the tail assembly of aircraft which uses the screen effect. GRA

N78-13021# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.

EVALUATION OF A POWER-AUGMENTED-RAM WING OPERATING FREE IN HEAVE AND PITCH OVER WATER Final Report, Oct. 1976 - Aug. 1977

Fred H. Krause Aug. 1977 78 p refs
(AD-A045428; DTNSRDC-ASED-385) Avail: NTIS HC A05/MF A01 CSCL 01/3

An investigation was conducted at the David W. Taylor Naval Ship Research and Development Center Carriage III Facility to determine performance characteristics of a power-augmented-ram wing-in-ground-effect vehicle. The model was the first statically stable vehicle to be operated free in heave and pitch with excess thrust. The power-augmented-ram vehicle successfully accomplished a static takeoff at the extremely low thrust-to-weight ratio of 0.173. The model was able to accelerate through hump at a vehicle density of 2 lb/cu ft (32 kg/cu m); this is a higher density than in any previous test. Trimming moments were supplied by one of several aerodynamic/hydrodynamic control surfaces. The best performance was obtained using a large 40 deg deadrise, 'V' shaped, planing tail. Author (GRA)

N78-13022# Sandia Labs., Albuquerque, N. Mex.

DIGITAL SPECTRAL ANALYSIS AND FILTERING OF EXPERIMENTAL AERODYNAMIC DATA

E. L. Clark and R. H. Croll, Jr. May 1977 58 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0225) Avail: NTIS HC A04/MF A01

Digital frequency analysis techniques are used to determine the frequency content of a set of time dependent data and to improve the quality of the data by eliminating undesired frequencies. An introduction to the use of these techniques is provided with nonrandom data. Guidelines for acquisition and processing of data, calculation and interpretation of digital spectral estimates, and application of digital filters are included. The techniques are demonstrated by use of three examples derived from wind tunnel data: frequency analysis of 3 DOF angular motion data, elimination of extraneous frequencies in dynamic stability data, and determination of control surface forcing function frequencies. ERA

N78-13023# Aircraft Research Association Ltd., Bedford (England).

NUMERICAL METHODS FOR TWO-DIMENSIONAL AND AXISYMMETRIC TRANSONIC FLOWS

M. J. Langley London Aeron. Res. Council 1977 58 p refs Presented at Euromech 40, Stockholm, Sep. 1973 Supersedes ARC-34701
(ARC-CP-1376; ARC-34701) Avail: NTIS HC A04/MF A01; HMSO£2.50; PHI $9.70

Two methods are presented for the calculation of transonic flows. Firstly, a method is described for the design of airfoils with prescribed pressure distributions including shock waves. The method is essentially an inversion of a numerically refined version of the Murman-Krupp technique for the solution of the transonic small perturbation equation with linearized boundary conditions. To demonstrate the usefulness and accuracy of the method examples are shown of the design of supercritical type airfoil sections, the final results being compared with calculations by the nominally exact Garabedian & Korn analysis method. The second method is for the calculation of asymmetric transonic flow past bodies of revolution. Following Garabedian & Korn the exact potential flow equations are solved in the inside of the unit circle obtained from the body contour by conformal transformation. The particular problems of calculating axisymmetric flows by such methods are discussed and examples are shown of calculations by the present method compared with other methods and experimental data. Author (ESA)

N78-13024# Royal Aircraft Establishment, Farnborough (England). Structures Dept.

AN INFLUENCE-COEFFICIENT APPROACH TO STATIC AEROELASTIC PROBLEMS AND A COMPARISON WITH EXPERIMENTS ON A FLEXIBLE WIND-TUNNEL MODEL

Dorothy M. Holford and A. S. Taylor London Aeron. Res. council 1977 69 p refs Supersedes RAE-TR-76079; ARC-37156
(ARC-CP-1379; RAE-TR-76079; ARC-37156) Avail: NTIS HC A04/MF A01; HMSO£3; PHI $11.60

A brief review of the development of finite element methods for estimating static aeroelastic effects is followed by a generalized restatement of the underlying mathematical theory of the influence coefficient technique for determining static loading on a deformable aircraft. Comparative results of recent RAE wind tunnel tests on two similarly configured models, which had, respectively, rigid and flexible swept wings, have been used, in conjunction with calculations, to assess the accuracy of the technique. A preliminary comparison of the calculated and measured results indicated an encouraging measure of agreement as regards the overall lift and pitching-moment characteristics. A more detailed analysis revealed some discrepancies the origins of which have not been determined with any certainty, although certain potential sources of error have been identified. Author (ESA)

N78-13025# European Space Agency, Paris (France).
TWO-DIMENSIONAL MODEL FOR THE FORMATION OF VORTEX SHEETS SHED BY THE LATERAL EDGE OF A WING
Philippe Joncheray Oct. 1977 72 p refs Transl. into ENGLISH of 'Modele Bidimensionnel pour la Formation des Nappes Tourbillonnaires s'Echappent du Bord Lateral d'une Aile', ONERA, Paris Report ONERA-NT-1977-5, 1977 Original report in FRENCH previously announced as N77-30430
(ESA-TT-413; ONERA-NT-1977-5) Avail: NTIS HC A04/MF A01

The formation of the vortex sheet shed by the lateral edge of a thin wing, at low angle of attack, set in motion by an impulse in an incompressible viscous fluid, was studied using an unsteady two-dimensional model. It is shown, by an asymptotic analysis of the three-dimensional flow, that the Navier-Stokes equations in a vicinity of the lateral edge are divided into a system that governs the two-dimensional flow in the plane normal to the wing and a scalar equation for the longitudinal velocity component, and that as long as a specific condition is fulfilled. Moreover, for a wing with parabolic section, a study in order of magnitude of the terms intervening in the equations of the two-dimensional model of passing round this edge leads to a validity condition of this model to describe the sheet formation. Two numerical methods were compared for the solution of this problem: the first makes use of the Dufort-Frankel scheme for the vortex calculation and an overrelaxation method for the stream function; the second is derived from the integro-differential method of Wu and Thompson: computation of the velocity by an integral formula and utilization of the same scheme for the vortex calculation. The first method, being much faster than the second, was used for calculations for Reynolds numbers 100, 500, and 1000. For the first two, calculation was stopped after reaching an important separation. For R = 1000, the calculation was pursued up to the appearance of a vortex sheet. The flow is visualized by streamlines and iso-vortex lines. The trajectories of some particles, which display a helix shape characteristic of the unsteady aspect of the phenomenon, were traced. Author (ESA)

N78-13026# European Space Agency, Paris (France).
PREDICTION OF THE ONSET AND DEVELOPMENT OF BOUNDARY LAYER TRANSITION
Roger Michel Oct. 1977 35 p refs Transl. into ENGLISH of 'Prevision de l'Apparition et du Develop. de la Transition de la Couche Limite', ONERA, Paris Report ONERA-NT-1977-6, 1977 Original report in FRENCH previously announced as N77-30430
(ESA-TT-414; ONERA-NT-1977-6) Avail: NTIS HC A03/MF A01

Existing means of predicting the onset of the boundary layer transition and its development up to the established turbulent regime, in the field of incompressible or moderately compressible flows, were analyzed. Practical techniques of prediction are reviewed, and available empirical criteria and approximate methods for calculating the boundary layer, starting from a given beginning of transition, are discussed. Special attention is paid to recent methods of prediction, using transport equations to describe the development of the turbulence in the boundary layer during transition. It is shown by different examples of application that this is a technique which permits making a reasonable prediction of the onset and development of transition, in good agreement with experiments. Author (ESA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N78-13027*# American Airlines, Inc., New York.
A NEW METHOD FOR ESTIMATING CURRENT AND FUTURE TRANSPORT AIRCRAFT OPERATING ECONOMICS Contractor Report, Jan. 1976 - Oct. 1977
Jan. 1978 267 p refs
(Contract NAS1-14284)
(NASA-CR-145190; D6-42877) Avail: NTIS HC A12/MF A01 CSCL 05C

A methodology was developed by which the operating cost associated with variations in aircraft design and technology characteristics can be assessed. This methodology addresses aircraft related operating cost elements and is based on an in-depth examination of airline operating experiences and relevant operating data. The assessment method produces a base line estimate of the operating cost elements relating to such design specification features as seat capacity, avionic equipment, design range, and design definition features such as maximum takeoff gross weight, and number of engines. Means for determining the deviations from this base line of the design or technological difference at the specific ATA System level are provided. The methodology was applied to assess the operating cost of one potential future advanced technology transport aircraft. An analysis was included to show the relative sensitivity of the operating cost to design parameters. Areas of potential future research on operating cost related technologies are identified. Author

N78-13028*# Douglas Aircraft Co., Inc., Long Beach, Calif.
CHARACTERIZATION OF SECONDARY IGNITION SOURCES IN UNATTENDED COMPARTMENTS AND FULL-SCALE BASELINE TEST Final Report, May - Dec. 1977
Davis M. Klink Nov. 1977 67 p refs
(Contract NAS9-14948)
(NASA-CR-151573; JSC-13792) Avail: NTIS HC A04/MF A01 CSCL 01C

The characteristics of five fuel loads burned within a metal lavatory were identified. In 15 of the tests the lavatory door remained closed for the 30-minute test period while in 15 additional tests the door was opened after the fire had developed. Upon completion of these tests the most severe source was selected for use in the baseline test. In the baseline test, the lavatory and adjacent panels, all of which were constructed of contemporary materials, were tested for a period of 1 hour. Thermal, environmental, and biological data were obtained for all fuel loads, door conditions, and the baseline test. All tests were conducted in a cabin fire simulator with separate ventilation of the cabin and lavatory representative of an inflight condition. The baseline test established that by using the most severe fuel source: (1) the exposed animal subject survived without complications; (2) no toxic levels of gas within the cabin were detected; (3) a propagating fire did not develop in adjacent structures; (4) the lavatory containing the fire remained structurally intact; (5) decomposition of portions of the lavatory did occur; and (6) cabin visibility would have presented a problem after 5 minutes. Author

N78-13029*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF LANDING APPROACH METHODS AND SEPARATION INTERVALS ON SINGLE RUNWAY LANDING CAPACITY
Earl C. Hastings, Jr. and Robert T. Taylor Dec. 1977 40 p

refs
(NASA-TP-1112; L-11834) Avail: NTIS HC A03/MF A01 CSCL 17G

The effect of seven approach methods on the landing capacity of commercial jet transports was studied. A dual-path approach concept, which offered vortex avoidance advantages, was found to provide significant gains with the current separation intervals. When this concept was combined with reduced intervals, the current landing capacity was approximately doubled. The anticipated increase in the demand for air transportation will require advanced approach methods, greatly reduced separation intervals, and larger proportions of high-passenger-capacity aircraft. Author

N78-13030# General Accounting Office, Washington, D. C. Community and Economic Development Div.

WHY THE FEDERAL AIRLINE SUBSIDY PROGRAM NEEDS REVISION: CIVIL AERONAUTICS BOARD

19 Aug. 1977 41 p
(PB-271238/8; CED-77-114) Avail: NTIS HC A03/MF A01 CSCL 05A

The need for the Congress to provide the Civil Aeronautics Board with a legislative mandate to restructure the airline subsidy program to insure necessary air services to small communities at the least cost to the Federal Government was discussed. Some ways in which program effectiveness can be improved were identified. GRA

N78-13031# California Univ., Los Angeles. Dept. of Chemical, Nuclear, and Thermal Engineering.

CATASTROPHIC EVENTS LEADING TO DE FACTO LIMITS ON LIABILITY

K. A. Solomon and D. Okrent May 1977 37 p refs
(Grant NSF OEP-75-20318)
(PB-271427/7; UCLA-ENG-7732; NSF/RA-770131) Avail: NTIS HC A03/MF A01 CSCL 05C

An overview was conducted of large technological systems in society to ascertain prevalence, if any, of situations that can lead to catastrophic effects where the resultant liabilities far exceed the insurances of assets subject to suit in court, thereby imposing de facto limits on liability. Several potential situations are examined: dam rupture, aircraft crash into a sports stadium, chemical plant accident, shipping disaster, and a toxic drug disaster. All events are estimated to have probabilities per year similar to a major nuclear accident and they are found to involve potential liability far exceeding insurance, corporation assets or government revenues. GRA

N78-13032# Advisory Group for Aerospace Research and Development, Paris (France).

THE PRINCIPLES OF UNDERWATER ESCAPE FROM AIRCRAFT

A. F. Davidson Nov. 1977 31 p refs
(AGARD-AG-230) Avail: NTIS HC A03/MF A01

The physical, mechanical, and physiological factors involved in escape from aircraft following ditching are reviewed. Some mechanical devices which can be used to assist the aircrew to reach the surface safely were described. Comments on the conduct of trials and the training of personnel in the techniques of underwater escape from aircraft are also included. Author

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N78-13033# Westland Helicopters Ltd., Yeovil (England).

HIGH DENSITY STABLE COLLISIONLESS AIR TRAFFIC: COMPUTER SIMULATIONS OF TRAFFIC MANAGEMENT IN THE ITV SYSTEM

O. Fitzwilliams and J. Yarker Nov. 1977 61 p refs
(RP-552) Avail: NTIS HC A04/MF A01

A system of air transport for the future is considered which envisages automatic operation of very large numbers of small vehicles. These craft will offer the traveller an airborne traverse at 200kt ground speed between air stations very close to the origin and destination of any journey. Computer simulations are presented to demonstrate the manner in which these vehicles can navigate, avoid collisions and preserve the stability of the resulting high density air traffic. The possibility that some of the features described might usefully be adapted to aid collision avoidance in existing air traffic is briefly discussed. Author

N78-13034# Martin Marietta Aerospace, Denver, Colo. Denver Div.

DESIGN AND LABORATORY TESTING OF SELFCONTAINED HIGH ALTITUDE NAVIGATION SYSTEM. PHASE 1. THE SPACE SEXTANT AUTONOMOUS NAVIGATION ATTITUDE REFERENCE SYSTEM SS-ANARS Final Report, 7 Dec. 1975 - 29 Apr. 1977

A. Dale Mikelson Jul. 1977 95 p
(Contract F04701-76-C-0105)
(AD-A045322; MCR-77-196; SAMSO-TR-77-123) Avail: NTIS HC A05/MF A01 CSCL 17/7

This report summarizes the contract effort centered around the building and laboratory testing of a breadboard model of the Space-Sextant-Autonomous Navigation and Attitude Reference System (SS-ANARS). The results described are for the third of five phases of development of the SS-ANARS leading to the availability of the system for operational use on advanced space systems and covers effort performed from 8 December 1975 through 30 April 1977. The Space Sextant system, now called the Space Sextant Autonomous Navigation Attitude Reference System (SS-ANARS), navigates with an electro-optical-mechanical device that precisely measures the included angles between the moon's visible limb and the brighter stars. These angle measurements, together with lunar ephemeris, star directions and time provide the information needed to determine, with a Kalman recursive filter, satellite position in space to an accuracy of 800 ft (one sigma) in any earth orbit. The basic measurement for navigation, the included angle between stars and moon's limb, is augmented to improve system performance by allowing some measurements between the earth's visible limb and the stars. These measurements allow position state estimation to within 1 n mi within minutes after commencement of navigation. Since the Sextant is an optical device it has solar occultation constraint whenever the moon gets within 9 deg of the sun. GRA

N78-13035# Office of Telecommunications, Annapolis, Md.

AIR TRAFFIC CONTROL RADAR BEACON SYSTEM (ATCRBS) INTERFERENCE INVESTIGATION IN LOS ANGELES AREA

Robert M. Pratt and Robert J. Matheson Jun. 1977 169 p refs
(PB-270944/2; OTR-77-125) Avail: NTIS HC A08/MF A01 CSCL 17G

Signal environment measurements were conducted to identify unauthorized users of the 1030 MHz and 1090 MHz frequencies. Six days of simultaneous 1030 MHz signal environmental and common digitizer output measurements were conducted to correlate the dynamics of the aircraft transponder and interrogator environment with performance degradation at the FAA San Pedro Hill en route beacon. The general impact of adding beacon system to the environment that are not equipped with sidelobe suppression was measured. The measurements and analysis led to recommended beacon hardware changes and expansion of current coordination procedures to reduce interference. GRA

N78-13036# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.

ASD STROBE LIGHT EVALUATION Final Report, 3 Jun. 1975 - 22 Oct. 1976

Phillip L. Schmidlapp Jun. 1977 209 p refs
(AF Proj. 2713)
(AD-A045533; ASD-TR-77-33) Avail: NTIS HC A10/MF A01 CSCL 01/2

This report presents a synopsis of the literature search and testing conducted by ASD from 3 June 1975 to 22 October

1976 in an attempt to determine the specification requirements for strobe anticollision lights. The literature search resulted in a draft military specification for aircraft anticollision strobe lights which was circulated to the using commands and industry for comments 27 February 1976. Since the literature search had not provided quantitative data relative to required intensity, further investigation was deemed necessary. Testing was designed to generate data which could be extrapolated to determine intensity requirements for the specification. Test results indicate that strobe lights of intensities far exceeding those practical for aircraft installation would be required. The total effort resulted in the ASD recommendation that the proposed strobe light specification not be published as the visibility enhancement characteristics of the strobe lights when compared to the midair threat environment, offer very little, if any, added protection against midair collisions. ASD also recommended that the 'Force Wide Retrofit' action item of the General Officer Panel for Safety Matters be deleted. Any future strobe light activity should be based upon potential Life Cycle Cost advantages when they are used as functional replacements for the present rotating beacons. It was also recommended that the Midair Prevention System program, which was an outgrowth of early ASD proposals and which provides a systematic approach to the midair collision problem, be continued. Author (GRA)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N78-13037*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AEROELASTIC STABILITY ANALYSIS OF THE AD-1 MANNED OBLIQUE-WING AIRCRAFT

Michael J. Rutkowski Oct. 1977 23 p refs

(NASA-TM-78439; A-7219) Avail: NTIS HC A02/MF A01 CSCL 01C

The AD-1 manned flight test program was conducted to evaluate the stability, control and handling characteristics of oblique wing aircraft. The results of the aeroelastic stability analysis are presented for both the wing alone and the wing with ailerons. A comparison was made between the results obtained using the traditional k-method of flutter analysis and the results using the PK or British method of flutter analysis. Studies were performed using the latest version of the NASTRAN computer code as well as the PASS/FLUT program. Author

N78-13038*# Boeing Vertol Co., Philadelphia, Pa.

SIMULATION STUDY OF GUST ALLEVIATION IN A TILT ROTOR AIRCRAFT, VOLUME 1

A. K. Amos and H. R. Alexander Jun. 1977 174 p refs 2 Vol.

(Contract NAS2-8048)

(NASA-CR-152050; D210-11231-1) Avail: NTIS HC A08/MF A01 CSCL 01C

The response to vertical turbulence in cruise of the HTR XV-15 design is studied using simulation techniques. This design is a modified version of the XV-15 with a hingeless fiberglass soft-in-plane rotor system. The parameters of a gust alleviation system are determined and the performance of the system is evaluated over a range of cruise velocities and altitudes. Author

N78-13039*# Boeing Vertol Co., Philadelphia, Pa.

SIMULATION STUDY OF GUST ALLEVIATION IN A TILT ROTOR AIRCRAFT, VOLUME 2

A. K. Amos and H. R. Alexander Jun. 1977 349 p refs 2 Vol.

(Contract NAS2-8048)

(NASA-CR-152051; D210-11231-2) Avail: NTIS HC A15/MF A01 CSCL 01C

For abstract, see N78-13038.

N78-13040*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A PRELIMINARY STUDY OF THE PERFORMANCE AND CHARACTERISTICS OF A SUPERSONIC EXECUTIVE AIRCRAFT

Vincent R. Mascitti Sep. 1977 193 p refs

(NASA-TM-74055) Avail: NTIS HC A09/MF A01 CSCL 01C

The impact of advanced supersonic technologies on the performance and characteristics of a supersonic executive aircraft was studied in four configurations with different engine locations and wing/body blending and an advanced nonafterburning turbojet or variable cycle engine. An M 2.2 design Douglas scaled arrow-wing was used with Learjet 35 accommodations. All four configurations with turbojet engines meet the performance goals of 5926 km (3200 n.mi.) range, 1981 meters (6500 feet) takeoff field length, and 77 meters per second (150 knots) approach speed. The noise levels of of turbojet configurations studied are excessive. However, a turbojet with mechanical suppressor was not studied. The variable cycle engine configuration is deficient in range by 555 km (300 n.mi) but nearly meets subsonic noise rules (FAR 36 1977 edition), if coannular noise relief is assumed. All configurations are in the 33566 to 36287 kg (74,000 to 80,000 lbm) takeoff gross weight class when incorporating current titanium manufacturing technology. Author

N78-13041*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

ROTOR SYSTEMS RESEARCH AIRCRAFT SIMULATION MATHEMATICAL MODEL

Jacob A. Houck, Frederick L. Moore, James J. Howlett (Sikorsky Aircraft), Kenneth S. Pollock, and Mary M. Browne Nov. 1977 208 p refs

(NASA-TM-78629) Avail: NTIS HC A10/MF A01 CSCL 01C

An analytical model developed for evaluating and verifying advanced rotor concepts is discussed. The model was used during in both open loop and real time man-in-the-loop simulation during the rotor systems research aircraft design. Future applications include: pilot training, preflight of test programs, and the evaluation of promising concepts before their implementation on the flight vehicle. Author

N78-13042*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AIRCRAFT ENERGY EFFICIENCY LAMINAR FLOW CONTROL WING DESIGN STUDY

Tom F. Bonner, Jr., Joseph D. Pride, Jr., and William W. Fernald Oct. 1977 34 p refs

(NASA-TM-78634) Avail: NTIS HC A03/MF A01 CSCL 01C

An engineering design study was performed in which laminar flow control (LFC) was integrated into the wing of a commercial passenger transport aircraft. A baseline aircraft configuration was selected and the wing geometry was defined. The LFC system, with suction slots, ducting, and suction pumps was integrated with the wing structure. The use of standard aluminum technology and advanced superplastic formed diffusion bonded titanium technology was evaluated. The results of the design study show that the LFC system can be integrated with the wing structure to provide a structurally and aerodynamically efficient wing for a commercial transport aircraft. Author

N78-13043*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

FRICTION CHARACTERISTICS OF THREE 30 BY 11.5-14.5, TYPE 8, AIRCRAFT TIRES WITH VARIOUS TREAD GROOVE PATTERNS AND RUBBER COMPOUNDS

Thomas J. Yager and John L. McCarty Dec. 1977 25 p refs

(NASA-TP-1080; L-11808) Avail: NTIS HC A02/MF A01 CSCL 11G

A test program was conducted to evaluate friction performance and wear characteristics on wet runways of three 30 x 11.5-14.5, type B aircraft tires having two different tread patterns and natural rubber contents. All test tires had the standard three circumferential groove tread, but two had molded transverse grooves which extended from shoulder to shoulder. The tread rubber content of the two tires with transverse grooves differed in that one had a 100 percent natural rubber tread and the other had a rubber tread composition that was 30 percent synthetic and 70 percent natural. The third test tire had the conventional

100 percent natural rubber tread. Results indicate that the differences in tire tread design and rubber composition do not significantly affect braking and cornering friction capability on wet or dry surfaces. Braking performance of the tires decreases with increased speed, with increased yaw angle and, at higher speeds, with increased wetness of the surface. Author

N78-13044# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
THE USE OF MULTIFUNCTION KEYBOARDS IN SINGLE-SEAT AIR FORCE COCKPITS Final Report, 3 Jul. 1974 - 31 Dec. 1975
John M. Reising, Robert P. Bateman, Gloria L. Calhoun (Bunker-Ramo Corp.), and Emmett L. Herron (Bunker-Ramo Corp.) Apr. 1977 149 p refs
(Contracts F33615-73-C-0391; F33615-76-C-0013; AF Proj. 6190)
(AD-A044076; AFFDL-TR-77-9) Avail: NTIS HC A07/MF A01 CSCL 09/5

Two types of multifunction keyboards (MFKs), projection switches, and plasma panel were designed to consolidate many of the aircraft controls/displays into a single, easily-reachable control panel. Pilot performance while operating each type of MFK during simulated flight was examined. Also examined were four different arrangements of the task steps or logic levels across keyboards and the impact of both a center and side control stick location on front panel and right console MFK operation. Author (GRA)

N78-13045# Boeing Vertol Co., Philadelphia, Pa.
RELIABILITY, MAINTAINABILITY, AND PERFORMANCE ISSUES IN HYDRAULIC SYSTEM DESIGN Final Report
J. P. Silva and J. L. Hammond Jun. 1977 256 p refs
(Contract DAAJ02-75-C-0020; DA Proj. 1F2-62209-AH-76)
(AD-A045237; D210-11094-2; USAAMRDL-TR-77-6) Avail: NTIS HC A02/MF A01 CSCL 13/7

The program objective was to compare an Advanced Conventional Pressure (ACP) 3000-psi helicopter hydraulic system to a Very High Pressure (VHP) 8000-psi system in terms of benefits, drawbacks, and development requirements. The work included the assessment of the state of the art of helicopter hydraulic systems, the development of an evaluation methodology, and the selection of a helicopter to serve as a baseline and as a vehicle for the ACP and VHP designs. Author (GRA)

N78-13046# Rockwell International Corp., Columbus, Ohio. Missiles Systems Div.
RPV FLYING QUALITIES DESIGN CRITERIA Final Report, Jan. - Dec. 1976
Charles F. Prosser and Curtiss D. Wiler Dec. 1976 213 p refs
(Contract F33615-75-C-3159)
(AD-A045170; C76-1391/034C; AFFDL-TR-76-125) Avail: NTIS HC A10/MF A01 CSCL 01/2

The concept and philosophy for the organization of an RPV Flying Qualities Design Criteria are presented in a preliminary framework of criteria with supporting background and rationale. This report completes Phase II of a four-phase AFFDL/FGC program for the development of an RPV Flying Qualities Specification. The performance-oriented criteria are developed in hierarchical fashion from mission requirements, through total system requirements, to subsystem requirements. The criteria encompass automatic and manual controls, command and data link, controls and displays as well as vehicle stability and control. The material was based on an RPV literature search and review, and an evaluation of existing military specifications for piloted aircraft, such as MIL-F-8785B, MIL-F-83300, MIL-F-9490D (USAF), and MIL-C-18244A (Navy). Author (GRA)

N78-13047# Ohio State Univ., Columbus. Systems Research Group.
THE HELICOPTER ROUTE SELECTION MODEL (DYNFLITE) Final Report, Jan. 1972 - Aug. 1976
Gordon M. Clark, Don C. Hutcherson, and David C. Bitters 31 Aug. 1976 531 p refs
(Contract DAAG25-70-C-0311)
(AD-A045094; RF-2978-FR-76-4(0)) Avail: NTIS HC A23/MF A01 CSCL 01/2

This report describes the results of research to develop a helicopter attack route selection model, called DYNFLITE, for use in high resolution combat simulations such as DYNTACS X. The fundamental concept used in comparing alternative routes is the minimization of perceived threat under the constraint of attacking a target. Three alternative threat perception models were hypothesized and compared experimentally. The experiments consisted of map exercises using helicopter pilots with combat experience as subjects. The subjects selected routes in a variety of combat situations, and the model generated routes using inputs solicited from the subjects; then the subjects compared their routes with the model routes. One of the three threat perception models performed better than the others and appeared to produce routes that were acceptable to the pilot subjects. Author (GRA)

N78-13048# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
RIDE CHARACTERISTICS OF CATAMARAN SEA LOITER AIRCRAFT IN A SEAWAY Final Report
Basil S. Papadales, Jr. Jun. 1977 47 p refs
(AD-A045363; DTNSRDC-ASED-384) Avail: NTIS HC A03/MF A01 CSCL 01/3

Results from model tests of a catamaran sea loiter aircraft model conducted by The Netherlands Ship Model Basin in 1966 are reviewed. Data are also presented from recent tests of a similar model conducted at the David W. Taylor Naval Ship Research and Development Center. Results from both test programs show that the catamaran hull spacing has little effect on longitudinal motions; lateral motions are strongly affected by hull spacing. The heave and pitch reasonant frequencies are nearly equal. Hull geometry (other than spacing) and the location of the center of gravity have little effect on motions. The gross size of the aircraft and the various radii of gyration do influence motions. Little damping in roll and pitch is present. Motions of full-scale aircraft are extrapolated from these model results. These scaled data are compared to numerical predictions for similar designs. Heave accelerations at the center of gravity compare favorably; pitch and roll motions do not compare well. Author (GRA)

N78-13049# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
CORROSION PREDICTABILITY IN F-4 AIRCRAFT ASSIGNED TO THE PACIFIC AIR FORCES M.S. Thesis
Jerrold B. Harrington and Jacob Teomy Jun. 1977 93 p refs
(AD-A045277; AFIT-LSSR-19-77A) Avail: NTIS HC A05/MF A01 CSCL 01/3

Corrosion has become a serious problem in PACAF due to inadequate management attention in the areas of facilities, training, and manning. The purpose of this study was to construct a mathematical model useful for predicting base-level corrosion control man-hours. The utility of such a model would allow the manager to forecast his requirements for corrosion maintenance. Statistical analysis involved least squares multiple linear regression. Independent variables included: (1) aircraft historical data such as airframe hours, age, assignment history, and MDS; (2) maintenance data such as PDM hours, contract corrosion control hours, and time since last PDM; and (3) corrosion severity indices. Data on the variables used in the analysis were gathered from the AFLC GO-98 computer data bank and at Headquarters PACAF. Studied in this research were F-4 aircraft at four PACAF bases: (1) Kadena AB, Japan; (2) Clark AB, P. I.; (3) Kunsan AB, Korea; and (4) Osan AB, Korea. The results showed a statistically significant regression model, however, a relatively high standard error of the estimate limited its usefulness. Author (GRA)

N78-13050# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Vehicle Equipment Div.
DEVELOPMENT TESTS AND FLIGHT TEST OF GRAPHITE COMPOSITE LANDING GEAR SIDE BRACE ASSEMBLY FOR A37-B AIRCRAFT Final Technical Report, 15 May 1973 - 15 Mar. 1977
Peter F. Dexter and Gerald C. Shumaker Jul. 1977 59 p refs
(AD-A045761; AFFDL-TR-77-56) Avail: NTIS HC A04/MF A01 CSCL 01/3

This report describes the successful development, in-house

testing, and flight testing of a graphite/epoxy side brace for the A-37B aircraft landing gear. Author (GRA)

N78-13051# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
OPERATION OF REMOTELY PILOTED VEHICLE SYSTEMS FROM MULTIMISSION HYDROFOIL SHIPS
Maynard L. Hill Jun. 1977 92 p refs
(Contract N00017-72-C-4401)
(AD-A045824; APL/JHU/BAF-77-03) Avail: NTIS HC A05/MF A01 CSCL 01/3

Results of an investigation of the feasibility of installing an Over-the-Horizon (OTH) Mini Remotely Piloted Vehicle (RPV) system on a Multi-Mission Hydrofoil Ship are reported. Analyses have been made of Hydrofoil and Mini-RPV performance, and concepts for RPV launch, mission execution, and aircraft recovery are evaluated in terms of those performance figures to determine compatibility of the concepts with hydrofoils. Technical problems and risks are also identified. It is concluded that the Hydrofoil's operational environment has some characteristic features which tend to mitigate launch and recovery problems associated with wind, turbulence, and ship motions. A design for an optimized Mini RPV capable of carrying 45 lbs of OTH payload is presented, and optimum Hydrofoil ship handling procedures during operation of RPV's are described. Author (GRA)

N78-13052# Naval Academy, Annapolis, Md.
SINGLE BLADED TORQUELESS HELICOPTER DESIGN Final Report, 1976 - 1977
Martinus Maria Klijn 23 May 1977 143 p
(AD-A045375; USNA-TSPR-87) Avail: NTIS HC A07/MF A01 CSCL 01/3

There has been a standing need for small portable strap-on backpack helicopters. This paper describes the steps leading to the design and construction of a working prototype. The prototype has a single rotor blade 12 feet long balanced by a 4 foot spar supporting two counter rotating propellers. A belt power transmission system drives the propellers from a small two-stroke gasoline engine located at the center of rotation of the rotor. The device straps onto the pilot's back, and the pilots's legs act as the landing gear. Empty weight of the machine is 75 pounds and it can lift a total of 270 pounds. Performance figures are calculated to be: Top speed - 48 mph, cruise speed 38 mph, maximum rate of climb - 420 ft/min., minimum rate of descent (power off) -9.4 ft/sec, and fuel consumption - 1.5 gal/hr. Recommendations for future designs are given in the paper. Author (GRA)

N78-13053# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
NATFREQ: A COMPUTER PROGRAM FOR CALCULATING THE NATURAL FREQUENCY OF ROTATING CANTILEVERED BEAMS
Joseph B. Wilkerson Jan. 1977 50 p ref
(f32421210)
(AD-A045587; DTNSRDC-ASED-370) Avail: NTIS HC A03/MF A01 CSCL 01/3

A computer program was developed to evaluate the natural frequencies of model helicopter rotor blades for use in wind tunnel evaluations. This program, NATFREQ, calculates the uncoupled natural frequency and corresponding mode shape of the first, second, and third natural bending modes for a nonuniform cantilever beam rotating in a vacuum. The program includes centrifugal stiffening effects and allows for arbitrary radial distributions of blade mass and stiffness properties. The fundamental uncoupled torsional natural frequency may also be calculated for a nonrotating cantilevered nonuniform beam. The blade is represented by a series of concentrated masses connected by massless flexures. The method of calculation for both bending and torsion is by the use of influence coefficients and martix algebra. Comparison of calculated results for a uniform beam with the exact solution shows that good results are obtained in the fundamental mode for as few as five mass elements. However, calculated frequencies for the second and third modes of vibration show progressive error. This suggests that up to 20 elements should be used for satisfactory results in the higher modes for nonuniform properties. Author (GRA)

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N78-13054*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLIGHT-TEST EVALUATION OF TWO ELECTRONIC DISPLAY FORMATS FOR APPROACH TO LANDING UNDER INSTRUMENT CONDITIONS
Samuel A. Morello, Charles E. Knox, and George G. Steinmetz Dec. 1977 33 p refs
(NASA-TP-1085; L-11867) Avail: NTIS HC A03/MF A01 CSCL 01D

The results of a flight evaluation of two electronic display formats for the approach to landing under instrument conditions are presented. The evaluation was conducted for a base-line electronic display format and for the same format with runway symbology and track information added. The evaluation was conducted during 3 deg, manual straight-in approaches with and without initial localizer offsets. Flight path tracking performance data and pilot subjective comments were examined with regard to the pilot's ability to capture and maintain localizer and glide slope by using both display formats. Author

N78-13055# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.
FLIGHT EVALUATION PACER SYSTEMS LOW-RANGE AIRSPEED SYSTEM LORAS 1000 Final Report, Feb. - Mar. 1976
William Y. Abbott, Barclay H. Boirun, Gary E. Hill, and Edward J. Tavares May 1977 34 p
(AD-A045222; USAAEFA-75-17-1) Avail: NTIS HC A03/MF A01 CSCL 01/4

The Pacer Systems Inc. low-range airspeed system (LORAS 1000) was evaluated on a helicopter by the United States Army Aviation Engineering Flight Activity at Edwards Air Force Base, California, in February and March 1976. Properly calibrated and aligned, the LORAS 1000 accurately displays low airspeeds along the longitudinal and lateral axes. When located above the rotor hub resultant airspeed is also displayed. In forward and rearward flight the system output was linear except for small discontinuities at -10 and -10 knots true airspeed (KTAS). The system output was repeatable for the range tested (31 KTAS rearward to 122 KTAS forward). The density altitude displayed values were accurate for the range tested. No reliability or maintainability problems were encountered. Author (GRA)

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N78-13056*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF FUEL PROPERTIES ON PERFORMANCE OF SINGLE AIRCRAFT TURBOJET COMBUSTOR AT SIMULATED IDLE, CRUISE, AND TAKEOFF CONDITIONS
Helmut F. Butze and Arthur L. Smith Sep. 1977 21 p refs
(NASA-TM-73780; E-9336) Avail: NTIS HC A02/MF A01 CSCL 21E

The performance of a single-can JT8D combustor was investigated with a number of fuels exhibiting wide variations in chemical composition and volatility. Performance parameters investigated were combustion efficiency, emissions of CO, unburned hydrocarbons and nitrogen oxides, as well as liner temperatures and smoke. The most pronounced effects of changes

in fuel composition were observed at simulated cruise and takeoff conditions where smoke and liner temperatures increased significantly as the hydrogen content of the fuel decreased. At the simulated idle condition, emissions of CO and unburned hydrocarbons increased slightly and, accordingly, combustion efficiencies decreased slightly as the hydrogen content of the fuels decreased. Author

N78-13057*# General Electric Co., Cincinnati, Ohio.
AUGMENTOR EMISSIONS REDUCTION TECHNOLOGY PROGRAM Final Report
W. C. Colley, M. J. Kenworthy, and D. W. Bahr Nov. 1977 165 p refs
(Contract NAS3-19737)
(NASA-CR-135215; R77AEG593) Avail: NTIS HC A08/MF A01 CSCL 21E

Technology to reduce pollutant emissions from duct-burner-type augmentors for use on advanced supersonic cruise aircraft was investigated. Test configurations, representing variations of two duct-burner design concepts, were tested in a rectangular sector rig at inlet temperature and pressure conditions corresponding to takeoff, transonic climb, and supersonic cruise flight conditions. Both design concepts used piloted flameholders to stabilize combustion of lean, premixed fuel/air mixtures. The concepts differed in the flameholder type used. High combustion efficiency (97%) and low levels of emissions (1.19 g/kg fuel) were achieved. The detailed measurements suggested the direction that future development efforts should take to obtain further reductions in emission levels and associated improvements in combustion efficiency over an increased range of temperature rise conditions. Author

N78-13058*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
ADVANCED SUPERSONIC PROPULSION STUDY, PHASES 3 AND 4
Roy D. Allan and Warren Joy Nov. 1977 297 p refs
(Contract NAS3-19544)
(NASA-CR-135236; R77AEG635) Avail: NTIS HC A13/MF A01 CSCL 21E

An evaluation of various advanced propulsion concepts for supersonic cruise aircraft resulted in the identification of the double-bypass variable cycle engine as the most promising concept. This engine design utilizes special variable geometry components and an annular exhaust nozzle to provide high take-off thrust and low jet noise. The engine also provides good performance at both supersonic cruise and subsonic cruise. Emission characteristics are excellent. The advanced technology double-bypass variable cycle engine offers an improvement in aircraft range performance relative to earlier supersonic jet engine designs and yet at a lower level of engine noise. Research and technology programs required in certain design areas for this engine concept to realize its potential benefits include refined parametric analysis of selected variable cycle engines, screening of additional unconventional concepts, and engine preliminary design studies. Required critical technology programs are summarized. Author

N78-13059*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
HIGH FREQUENCY DYNAMIC ENGINE SIMULATION
J. A. Schuerman, K. E. Fischer, and P. W. McLaughlin Jul. 1977 166 p refs
(Contract NAS3-20292)
(NASA-CR-135313; PWA-5543) Avail: NTIS HC A08/MF A01 CSCL 21E

A digital computer simulation of a mixed flow, twin spool turbofan engine was assembled to evaluate and improve the dynamic characteristics of the engine simulation to disturbance frequencies of at least 100 Hz. One dimensional forms of the dynamic mass, momentum and energy equations were used to model the engine. A TF30 engine was simulated so that dynamic characteristics could be evaluated against results obtained from testing of the TF30 engine at the NASA Lewis Research Center. Dynamic characteristics of the engine simulation were improved by modifying the compression system model. Modifications to the compression system model were established by investigating the influence of size and number of finite dynamic elements. Based on the results of this program, high frequency engine simulations using finite dynamic elements can be assembled so that the engine dynamic configuration is optimum with respect to dynamic characteristics and computer execution time. Resizing of the compression systems finite elements improved the dynamic characteristics of the engine simulation but showed that additional refinements are required to obtain close agreement simulation and actual engine dynamic characteristics. Author

N78-13060*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLIGHT-EFFECTS ON PREDICTED FAN FLY-BY NOISE
Marcus F. Heidmann and Bruce J. Clark 1977 24 p refs Presented at 94th Meeting of the Acoustical Soc. of Am., Miami, Fla., 13-16 Dec. 1977
(NASA-TM-73798) Avail: NTIS HC A02/MF A01 CSCL 20A

The impact on PNLT (Perceived Noise Level, Tone corrected) and Fly-by EPNL (Effective Perceived Noise Level) when forward motion reduces the noise generated by the bypass fan of an aircraft engine was studied. Calculated noise spectra for a typical subsonic tip speed fan designed for blade passage frequency (BPF) tone cutoff were translated in frequency by systematically varying the BPF from 0.5 to 8 kHz. Two cases of predicted flight-effects on fan source noises were considered: reduced BPF tone level of 8 db and reduced broadband noise level of about 2 db in addition to reduced tone level. The maximum reduction in PNLT of the noise as emitted from the fan occurred when the BPF was at 4 kHz where the reductions were 7.4 and 10.0 db. The maximum reduction in EPNL of the noise as received during a 500-foot altitude fly-by occurred when the BPF was at 2.5 kHz where the reductions were 5.0 and 7.8 db. Author

N78-13061*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
AN EMPIRICAL MODEL FOR INVERTED-VELOCITY-PROFILE JET NOISE PREDICTION
James R. Stone 1977 30 p refs Presented at 94th Meeting of the Acoustical Soc. of Am., Miami, Fla., 13-16 Dec. 1977
(NASA-TM-73838; E-9425) Avail: NTIS HC A03/MF A01 CSCL 20A

An empirical model for predicting the noise from inverted-velocity-profile coaxial or coannular jets is presented and compared with small-scale static and simulated flight data. The model considered the combined contributions of as many as four uncorrelated constituent sources: the premerged-jet/ambient mixing region, the merged-jet/ambient mixing region, outer-stream shock/turbulence interaction, and inner-stream shock/turbulence interaction. The noise from the merged region occurs at relatively low frequency and is modeled as the contribution of a circular jet at merged conditions and total exhaust area, with the high frequencies attenuated. The noise from the premerged region occurs at high frequency and is modeled as the contribution of an equivalent plug nozzle at outer stream conditions, with the low frequencies attenuated. Author

N78-13062*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN OVERVIEW OF AEROSPACE GAS TURBINE TECHNOLOGY OF RELEVANCE TO THE DEVELOPMENT OF THE AUTOMOTIVE GAS TURBINE ENGINE
D. G. Evans and T. J. Miller 1978 52 p refs Presented at Ann. Meeting of the Soc. of Automotive Engineers, Detroit, Mich., 27 Feb. - 3 Mar. 1978
(NASA-TM-73849) Avail: NTIS HC A04/MF A01 CSCL 21E

Technology areas related to gas turbine propulsion systems with potential for application to the automotive gas turbine engine are discussed. Areas included are: system steady-state and transient performance prediction techniques, compressor and turbine design and performance prediction programs and effects of geometry, combustor technology and advanced concepts, and ceramic coatings and materials technology. Author

N78-13063*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MECHANICAL CHARACTERISTICS OF STABILITY-BLEED VALVES FOR A SUPERSONIC INLET
George H. Neiner, Miles O. Dustin, and Gary L. Cole Washington Dec. 1977 39 p refs

(NASA-TM-X-3483; E-8852) Avail: NTIS HC A03/MF A01 CSCL 21E

Mechanical characteristics of a set of direct-operated relief valves used in a throat-bypass stability-bleed system designed for the YF-12 aircraft inlet are described. A comparison of data taken before and after the windtunnel tests (at room temperature) showed that both the effective spring rate and the piston friction had decreased during the wind tunnel tests. In neither the effective spring rate nor the piston friction was the magnitude of change great enough to cause significant impairment of overall system effectiveness. No major valve mechanical problems were encountered in any of the tests. During high temperature bench tests, piston frictional drag increased. The friction returned to its initial room temperature value when the stability-bleed valve was disassembled and reassembled. The problem might be solved by using a different material for the piston sleeve bearing and the piston rings. Author

N78-13064*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

INFLUENCE OF OIL SQUEEZE-FILM DAMPING ON STEADY-STATE RESPONSE OF FLEXIBLE ROTOR OPERATING TO SUPERCRITICAL SPEEDS

Robert E. Cunningham Dec. 1977 44 p refs

(NASA-TP-1094; E-9091) Avail: NTIS HC A03/MF A01 CSCL 21E

Experimental data were obtained for the unbalance response of a flexible rotor to speeds above the third lateral bending critical. Squeeze-film damping coefficients calculated from measured data showed good agreement with short-journal-bearing approximations over a frequency range from 5000 to 31,000 cpm. Response of a rotor to varying amounts of unbalance was investigated. A very lightly damped rotor was compared with one where oil-squeeze dampers were applied. Author

N78-13065# School of Aerospace Medicine, Brooks AFB, Tex.

ORGANIC COMPOUNDS IN TURBINE COMBUSTOR EXHAUST Progress Report, Dec. 1974 - Sep. 1975

James P. Conkle, William W. Lackey, Charles L. Martin, and Richard L. Miller Sep. 1975 12 p refs

(AD-A045582; SAM-TR-75-340) Avail: NTIS HC A02/MF A01 CSCL 21/2

Trace organic compounds in aircraft turbine combustor exhaust were determined as functions of fuel type and engine operating pressure (power setting). Hydrocarbons were collected by multistage cryogenic sampling. Chemicals were analyzed by a coupled gas chromatograph-mass spectrometer-data system. Results are presented in the context of assessment of biomedical impact of aircraft operations. Author (GRA)

N78-13066# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

DEVELOPMENT OF EMISSIONS MEASUREMENT TECHNIQUES FOR AFTERBURNING TURBINE ENGINES, SUPPLEMENT 1

T. F. Lyon Oct. 1975 67 p Suppl. to R75-AEG547, AD-A019094

(Contract F33615-73-C-2047)

(AD-A045491; R75AEG458; AFAPL-TR-75-52-Suppl-1) Avail: NTIS HC A04/MF A01 CSCL 21/2

Comprehensive emissions test data were taken throughout the exhaust plumes of J85-5 and J79-15 afterburning engines. Measurements were obtained on both engines at four power settings (military, minimum A/B, intermediate A/B, and maximum A/B) and five axial stations (0, 3, 6, 12 and 24 nozzle diameters downstream). Author (GRA)

N78-13067# Westinghouse Electric Corp., Pittsburgh, Pa.

BRITTLE MATERIALS DESIGN, HIGH TEMPERATURE GAS TURBINE, VOLUME 1 Final Report, 1 Jul. 1971 - 30 Jun. 1976

Raymond J. Bratton and Donald G. Miller Dec. 1976 92 p Prepared for Ford Motor Co., Dearborn, Mich.

(Contract DAAG46-71-C-0162; ARPA Order 1849)

(AD-A045104; AMMRC-CTR-76-32-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 21/5

A highlight summary of the work conducted by Westinghouse from July 1971 to June 1976, on the Defense Advanced Research Projects Agency (DARPA) sponsored program, Brittle Materials Design, High Temperature Gas Turbines' is presented. The Westinghouse portion of the program entitled, 'Stationary Turbine Project,' was concerned with the development of ceramic design and materials technology for large, electric, power-generating, combustion turbines. Major incentives for the use of ceramic components in these turbines include significant improvements in the overall efficiency of power conversion through higher operating temperatures and minimum cooling requirements and extended component life through greater resistance to corrosion/erosion with a variety of fuels. The first stage ceramic stator vane with associated support hardware was chosen as the principal developmental objective. A test demonstration of design concepts and materials feasibility was achieved in a high temperature static rig at a peak vane temperature of 2500 F. Two series of 100 duty cycle testing to represent peaking turbine operation at 0.8 turbine simulation were performed at 2200 and 2500 F, respectively. The three piece vane assembly design concept was confirmed as viable and hot pressed silicon nitride emerged as the best candidate ceramic material for structural turbine applications. GRA

N78-13068# University of Southern Calif., Los Angeles. Dept. of Mechanical Engineering.

INTERACTION OF TURBULENT AIR JETS WITH AN IMPINGING REACTING STREAM: AN APPLICATION TO AN ADVANCED AIR BREATHING PROPULSION SYSTEM Final Report, 1 Jun 1972 - 1 Jun. 1977

P. Roy Choudhury Aug. 1977 93 p refs

(Grant AF-AFOSR-2400-72)

(AD-A045833; AFOSR-77-1234TR) Avail: NTIS HC A05/MF A01 CSCL 21/1

An important practical application of the interaction of turbulent air jets with an impinging reacting stream is described in this report. A system of cross-jets located upstream of the sudden expansion step of a dump burner is able to amplify the recirculation zone thereby increasing the flame spreading as well as the characteristic residence time. Furthermore, the cross-jets with mass flow rates in the range of 1% to 4% are able to smooth out rough burning in a small volume-limited burner without any additional drag penalty. The lean blow off performance, rough burning, flow field characteristics and preliminary scaling parameters for a dump burner with a system of cross-jets are given. A preliminary study of a cross-jet system performing the dual role of a vortex amplifier and swirl generator shows great promise. Because of encouraging results, recommendations are made to expand the activity to include swirl-jets in large combustors. Author (GRA)

N78-13069# Environmental Protection Agency, Ann Arbor, Mich. Standards Development and Support Branch.

SOURCES OF VARIABILITY AND INACCURACIES IN AIRCRAFT GAS TURBINE EMISSION MEASUREMENTS

Feb. 1976 32 p refs

(PB-270898/0; AC-76-02) Avail: NTIS HC A03/MF A01 CSCL 13B

Variability and inaccuracies in aircraft gas turbine emission measurements caused by calibration gases, instrument precision, sampling errors, engine setting precision, and ambient condition effects continue to be of major concern. Understanding and/or resolution of these factors is critical to the development of a unified measurement procedure. The various factors contributing to emission measurement inaccuracy are discussed for all major sections and components of the emission sampling system. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N78-13070*# Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.

EFFECTS OF DYNAMIC AEROELASTICITY ON HANDLING QUALITIES AND PILOT RATING

Wen-Yo Yen and Robert L. Swaim Dec. 1977 119 p refs (Grant NsG-4003)
(NASA-CR-155339; Rept-77-7) Avail: NTIS HC A06/MF A01 CSCL 01C

Pilot performance parameters, such as pilot ratings, tracking errors, and pilot comments were determined for a longitudinal pitch tracking task using a large, flexible bomber with parametric variations in the undamped natural frequencies of the two lowest frequency symmetric elastic modes. This pitch tracking task was programmed on a fixed base simulator with an electronic attitude-director display of pitch command, pitch angle, and pitch error. Low frequency structural flexibility significantly affects the handling qualities and pilot ratings in the task evaluated. Author

N78-13071*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF CONTROL INPUTS ON THE ESTIMATION OF STABILITY AND CONTROL PARAMETERS OF A LIGHT AIRPLANE
Robert L. Cannaday and William T. Suit Dec. 1977 72 p refs
(NASA-TP-1043; L-11355) Avail: NTIS HC A04/MF A01 CSCL 01C

The maximum likelihood parameter estimation technique was used to determine the values of stability and control derivatives from flight test data for a low-wing, single-engine, light airplane. Several input forms were used during the tests to investigate the consistency of parameter estimates as it relates to inputs. These consistencies were compared by using the ensemble variance and estimated Cramer-Rao lower bound. In addition, the relationship between inputs and parameter correlations was investigated. Results from the stabilator inputs are inconclusive but the sequence of rudder input followed by aileron input or aileron followed by rudder gave more consistent estimates than did rudder or ailerons individually. Also, square-wave inputs appeared to provide slightly improved consistency in the parameter estimates when compared to sine-wave inputs. Author

N78-13072# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LATERAL STABILITY OF AN AIRCRAFT AND VIBRATIONS OF THE AILERONS WHILE TAKING INTO CONSIDERATION ELASTIC DEFORMATION OF THE WINGS AND THE ELASTICITY OF THE CONTROL SYSTEM
J. Maryniak and M. Zlocka 10 Jun. 1977 32 p refs Transl. into ENGLISH from Mech. Teoretyczna i Stoswana (Poland), v. 14, no. 1, 1976 p 63-81
(AD-A045440; FTD-ID(RS)T-0763-77) Avail: NTIS HC A03/MF A01 CSCL 01/3

In this work there has been investigated the influence of stiffness and damping in the system of control (guidance) by ailerons while taking into consideration the elastic deformation of the wings on the lateral stability of the aircraft as well as the vibrations of the ailerons. The aircraft has been treated as a rigid mechanical system with elastically deformable wings and movable ailerons. The equations of motion have been worked out in quasi-coordinates using the Boltzmann-Hamel equations for mechanical systems with holonomic constraints in a system of coordinates connected with the aircraft. GRA

N78-13073# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
FLUTTER OF CONTROL SURFACES WITH STRUCTURAL NONLINEARITIES Final Report, 1 Jun. 1976 - 31 Aug. 1977
Robert M. Laurenson and Robert M. Trn 31 Aug. 1977 117 p refs
(Contract N00019-76-C-0524)
(AD-A045221; MDC-E1734) Avail: NTIS HC A06/MF A01 CSCL 16/4

Missile control surface systems often contain structural nonlinearities which affect their performance characteristics and flutter boundaries. Presented in this report are flutter analysis procedures which have been developed to evaluate the potential influence of these nonlinearities on control surface flutter. Three types of nonlinearities: freeplay, preload, and friction, have been investigated. The describing function technique, which has found application in dealing with nonlinearities in automatic control systems, has been used to mathematically represent these nonlinearities during the investigation. A simplified representation of the aerodynamic loadings acting on the control surface has been assumed and the techniques have application for either a rigid or flexible control surface. Numerous examples of the application of the developed flutter analysis techniques are presented. Author (GRA)

N78-13074# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
FAULT TOLERANT DIGITAL FLIGHT CONTROL WITH ANALYTICAL REDUNDANCY Final Report, 1 Jan. 1976 - 1 Feb. 1977
Tom Cunningham, Don Carlson, Russ Hendrick, Don Shaner, and Gary Hartmann May 1977 396 p refs
(Contract F33615-76-C-3031; AF Proj. 1987)
(AD-A045671; AFFDL-TR-77-25) Avail: NTIS HC A17/MF A01 CSCL 01/3

Analytical redundancy offers high potential for solving the sensor redundancy problem. The current state-of-the-art in analytical redundancy contains a number of candidate filters which are developed here from a fundamental relationship of variables through hybrid simulation. Three analytical redundancy concepts of varying complexity were developed for the A-7 D aircraft. Two monitor techniques were used; a multiple trip level exceedance criteria currently in use with voting systems, and a sequential likelihood ratio hypothesis test SLRT on the mean value of the error signal. Results indicate that fault detection, whether designed by Classical methods or Kalman filtering, perform similarly and that gust estimation improves fault detection performance. Also, failure isolation for a single set of unlike sensors is difficult to achieve with a reasonable computation load. The output recommendation is to proceed to flight test with a set of nonlinear diagnostic filters to be used with comparison monitors for dual sensor failure isolation, creating a fail-operative dual sensor system. Fail-safe operation will also be achieved by continuing to monitor the filters and to detect, but not isolate, a second failure. Author (GRA)

N78-13075# Systems Control, Inc., Palo Alto, Calif.
CONTROL THEORY AND NAVY APPLICATIONS
Michael D. Ciletti and James S. Tyler Aug. 1977 682 p Symp. held at U. S. Naval Postgraduate School, Monterey, Calif., 15-17 Jul. 1975
(Contract N00014-72-C-0327)
(AD-A045603) Avail: NTIS HC A99/MF A01 CSCL 15/7

This report contains the proceedings of a conference on the application of control theory to Navy problem areas. Papers are included on Navy and other Government program areas where control theory has been applied; and on the state-of-the-art of various aspects of control theory, including control, estimation, and identification. Summaries of panel discussions are included which address where control theory has been applied and where additional research efforts should be directed. Author (GRA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N78-13076*# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
SELF STREAMLINING WIND TUNNEL: LOW SPEED TESTING AND TRANSONIC TEST SECTION DESIGN Semiannual Progress Report, Apr. 1976 - Dec. 1976
S. W. D. Wolf and M. J. Goodyer Oct. 1977 70 p refs
(Grant NsG-7172)
(NASA-CR-145257) Avail: NTIS HC A04/MF A01 CSCL 14B

Comprehensive aerodynamic data on an airfoil section were obtained through a wide range of angles of attack, both stalled

and unstalled. Data were gathered using a self streamlining wind tunnel and were compared to results obtained on the same section in a conventional wind tunnel. The reduction of wall interference through streamline was demonstrated. Author

N78-13077*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COMBUSTOR FLUCTUATING PRESSURE MEASUREMENTS IN-ENGINE AND IN A COMPONENT TEST FACILITY: A PRELIMINARY COMPARISON

Meyer Reshotko and Allen Karchmer 1977 19 p refs Presented at 94th Meeting of the Acoust. Soc. Am., Miami Beach, Fla., 13-16 Dec. 1977

(NASA-TM-73845; E-9432) Avail: NTIS HC A02/MF A01 CSCL 14B

In a program to investigate combustor noise, measurements were made with a YF-102 engine of combustor internal fluctuating pressure and far field noise. The relationship of far field noise to engine internal measurement was ascertained. The relationships between combustor internal measurements obtained in an engine and those obtained in a component test facility were established by using a YF-102 combustor, instrumented identically with that used in the engine tests. The combustor was operated in a component test facility over a range of conditions encompassing engine operation. A comparison of the directly measured spectra at corresponding locations in the two tests showed significant differences. The results of two point signal analyses within each combustor, were similar for both tests, indicating that the internal dynamics of the combustor as an acoustic source are preserved in a component test facility. Author

N78-13078# New Mexico Univ., Albuquerque. Civil Engineering Research Facility.

METHODOLOGY FOR DETERMINING, ISOLATING, AND CORRECTING RUNWAY ROUGHNESS Final Technical Report, 1 Dec. 1975 - 30 Mar. 1977

Douglas R. Seeman and John P. Nielsen Jun. 1977 33 p refs Sponsored in part by FAA

(Contract F29601-76-C-0015)

(AD-A044328/3; CERF-AP-24; FAA-RD-75-110-2) Avail: NTIS HC A03/MF A01 CSCL 01/5

Elevation and acceleration profiles were generated to determine the relationship between runway roughness and aircraft response. The aircraft response is specified in terms of pilot-station vertical accelerations, which are determined from computer simulation. Corrections to the profiles are then made to reduce the aircraft response. Author

N78-13079# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soils and Pavements Lab.

ANALYSIS OF PERMANENT DEFORMATIONS OF FLEXIBLE AIRPORT PAVEMENTS Final Report

Yu. T. Chou Feb. 1977 118 p refs

(Contract DOT-FA73WAI-377)

(AD-A044269/9; TR-S-77-8; FAA-RD-77-6) Avail: NTIS HC A06/MF A01 CSCL 01/5

The deformation characteristics of component materials in a flexible pavement system subject to moving aircraft loadings were investigated, and a prediction model to estimate permanent deformation was developed. A literature survey was first conducted on the deformation characteristics of pavement component materials and the computational technique to predict the amount of deformation. Series of laboratory repeated load tests measuring permanent strain were performed on subgrade soil and untreated granular materials. The results were used as input to a layered elastic computer program to determine the accumulated permanent deformation that occurred in each layer of the pavement. Pavements used in the analysis were full-scale multiple-wheel heavy gear load test sections. The literature survey indicated that predicting permanent deformation in the asphaltic concrete layer is not only very costly and time consuming but also may be incorrect. Different patterns of permanent strain along the asphalt layer were computed by different authoritative agencies. Results revealed that permanent deformation in the untreated granular layer cannot be predicted with accuracy. Author

N78-13080# ARO, Inc., Arnold Air Force Station, Tenn.

A STUDY OF ACOUSTIC DISTURBANCES AND MEANS OF SUPPRESSION IN VENTILATED TRANSONIC WIND TUNNEL WALLS Final Report, 1 Jul. 1975 - 30 Jun. 1976

N. S. Dougherty, Jr. AEDC Oct. 1977 102 p refs Sponsored by the AF

(AD-A045347; ARO-PWT-TR-77-36; AEDC-TR-77-67) Avail: NTIS HC A06/MF A01 CSCL 09/5

An experimental investigation of acoustic disturbances and means of suppression from ventilated transonic wall samples was performed in a low-background-noise research tunnel at AEDC. Configurations for ventilation investigated were longitudinally slotted walls, with and without baffles in the slots, slats versus round rods, and perforated walls with normal or inclined circular holes with varied hole sizes and varied diameter/wall thickness ratio. Comparative acoustic data were acquired over a broad range of subsonic Mach numbers. Several of these wall configurations were found to emit intense, discrete whistling noise with overall root-mean-square amplitudes as large as five percent of the free-stream dynamic pressure. In all cases except one, suppressed noise levels not exceeding 0.75 percent of the free-stream dynamic pressure were achieved compared to a background noise level for the tunnel of approximately 0.4 7 percent with solid test section walls. Noise suppression was accomplished by means of appropriate devices added to the wall samples which could have application to actual transonic wind tunnel test sections. Author (GRA)

N78-13081# McDonnell Aircraft Co., St. Louis, Mo.

HIGH ACCELERATION COCKPIT SIMULATOR EVALUATION

Edward P. Prouhet and Philip V. Kulwicki Jun. 1977 17 p

(Contract F33615-75-C-5087)

(AD-A045165; AMRL-TR-75-123) Avail: NTIS HC A02/MF A01 CSCL 01/3

Since 1970, the Aerospace Medical Research Laboratory (AMRL) and the Air Force Flight Dynamics Laboratory (AFFDL) have jointly sponsored a unique and innovative approach to fighter cockpit design termed the High Acceleration Cockpit (HAC). As a result of indicated improvements in pilot-vehicle compatibility during and following exposure to moderate-to-high G force fields, HAC is entering a stage of advanced development and planned flight demonstration by AFFDL. Improved pilot capability with HAC results from repositioning the pilot to place him in a more favorable position with respect to the applied loads, thereby reducing the chance of grayout and blackout as well as improving tracking ability and resistance to body fatigue. The material presented herein is from a comprehensive manned simulator assessment of the tactical utility and combat capability projected for the HAC concept. Systems were completely modeled, including aircraft and weapon dynamics, cockpit with flight control and fire control systems. A full complement of offensive and defensive situation displays and cues were provided to cover all aspects of the simulated combat. Selected results are presented to illustrate that, relative to conventional cockpit design, the configuration employing HAC was able to decisively control the engagements. GRA

N78-13082# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Aerodynamische Versuchsanstalt.

THE NEED FOR A LARGE EUROPEAN HIGH REYNOLDS NUMBER TRANSONIC WINDTUNNEL LEHRT AND THE EXPECTED GERMAN WORKLOAD Final Report

Jan vdDecken, Bernd Ewald, Helmut Grauer-Carstensen, Werner Heinzerling, and Wolfgang Lorenz-Meyer Bonn Bundesmin. fuer Forsch. u. Technol. Aug. 1977 48 p refs Prepared jointly with Dornier System GmbH, MBB GmbH, Ottobrunn, West Ger., and Ver. Flugtech. Werke Fokker GmbH, Bremen

(Contract BMFT-LFT-7504-I)

(BMFT-FB-W-77-01) Avail: NTIS HC A03/MF A01

The need for a high Reynolds number transonic wind tunnel for Europe has been well established by the Large Windtunnels Working Group (LaWs) of AGARD. Preparatory investigations for the design of an adequate facility are pursued at present. The urgent need for such a tunnel is explained, especially from the point of view of German aircraft research and industry, and a survey of the expected German workload for such a facility is

given. It is pointed out what reduction of risk or what improvement in aircraft performance, i.e. financial savings will result from the availability of such a wind tunnel. It is made clear that economical improvements as stated will be crucial concerning the successful design of competitive future aircraft and that, thus, the availability of a high Reynolds number transonic wind tunnel alone, perhaps more than its actual amount of utilization, may be decisive in the survival of the European aircraft industry. Author (ESA)

N78-13083# European Space Agency, Paris (France).
EUROPEAN SPACE TRIBOLOGY LABORATORY. AN INTRODUCTION TO ITS CAPABILITIES
Jun. 1977 15 p refs
(ESA-SP-1004) Avail: NTIS HC A02/MF A01

A description is given of the European Space Tribology Laboratory (ESTL). This laboratory performs three distinct, though related, functions: mechanism testing for ESA and European space companies, development program in support of all ESA programs, and consultancy service in space tribology. The laboratory is operated by the British National Centre of Tribology. The facilities available at ESTL are outlined. A list of ESTL reports is included. ESA

N78-13084# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
THE CALIBRATION OF INJECTOR-POWERED ENGINE SIMULATORS FOR USE IN PRESSURISED WIND TUNNELS
A. Masson (ONERA, Modane, France) and D. N. Foster London Aeron. Res. Council 1977 52 p refs Supersedes RAE-TR-76018; ARC-36787
(ARC-CP-1377; RAE-TR-76018; ARC-36787) Avail: NTIS HC A04/MF A01; HMSO£2.50; PHI $9.70

The possibility of using the S3 wind tunnel at Modane-Avrieux to calibrate injector-powered engine simulators was investigated by ONERA using two engine simulators; one built by ONERA to simulate an engine with a by-pass ratio of 10 (M45S), and one built by RAE to simulate an engine with a by-pass ratio of 5 (RB 211). Tests were carried out over a range of stagnation pressures of both the primary (inducing) flow and of the external (induced) flow, under static and low forward speed conditions, with the models at zero angle of incidence. The tests showed that it would be possible to use the S3 wind tunnel to calibrate future engine simulators, and also that, for the conditions tested, the stagnation pressure of the induced flow had only a minimal effect on the nondimensional performance of the engine simulator. A description is also given of the tests made in a specially-designed static rig to develop the configuration of the primary nozzles for the ONERA model engine. Author (ESA)

N78-13085# Oxford Univ. (England). Engineering Lab.
THE 4m X 2m INDUSTRIAL AERODYNAMICS WIND TUNNEL
C. J. Wood 1977 47 p refs
(OUEL-1188/77) Avail: NTIS HC A03/MF A01

A new wind tunnel was designed and built at the university specifically to provide a testing facility for architectural and industrial aerodynamics. The working section is 14 m in length so that simulation of the atmospheric wind can be arranged by inserting appropriate turbulence and velocity profile generators. Alternatively, the empty tunnel, having a construction area of 2.8:1 provides a steady uniform flow with an average turbulence level less than 0.6 % and a mean speed up to 30 m/s. The tunnel has twin diffusers leading to a pair of commercial constant speed variable pitch fans, for which a suitable control system was developed. It is now fully operational with a data acquisition system based on a PDP 11 on-line computer.
Author (ESA)

N78-13086# Oxford Univ. (England). Engineering Lab.
A NEW TRANSIENT CASCADE FACILITY FOR THE MEASUREMENT OF HEAT TRANSFER RATES
D. L. Schultz, T. V. Jones, M. L. G. Oldfield, and L. C. Daniels 26 Jul. 1977 28 p refs
(Grant SRC-B/SR/89866)
(OUEL-1207/77) Avail: NTIS HC A03/MF A01

A new type of transient cascade was developed for testing turbine blades and nozzle guide vanes at full scale engine Reynolds and Mach numbers. It is based on a free piston compressor capable of producing uniform flow conditions for periods between 0.3 and 1.0 secs. Heat transfer rate measurements are made using thin film surface resistance thermometers deposited onto insulating substrates such as quartz or machinable glass ceramic. Pressure distributions may also be obtained using conventional model techniques. Flow visualization using schlieren and holographic techniques has also been employed and typical results from rotor blades will be presented. The principle of operation of the cascade is described together with the basis of its mechanical design and the predicted performance compared with experimental observations. The technique is shown to have advantages both in cost and effectiveness over continuous running cascades.
Author (ESA)

N78-13087# Oxford Univ. (England). Engineering Lab.
AN ON-LINE INTERACTIVE MINI-COMPUTER SYSTEM FOR HEAT TRANSFER MEASUREMENTS IN A TRANSIENT TURBINE CASCADE
M. L. G. Oldfield, T. V. Jones, and D. L. Schultz Sep. 1977 14 p refs
(Grant SRC-B/SR/89866)
(OUEL-1215/77) Avail: NTIS HC A02/MF A01

A 32 channel computer based data acquisition and processing system was developed for use with the new type of transient cascade facility at Oxford. This is used for testing turbine blades and nozzle guide vanes at full scale engine Reynolds and Mach numbers with correct wall to flow temperature ratios. A novel technique for processing transient heat transfer data from thin film surface resistance thermometers was developed. Measurements of surface pressure around blades, and of the upstream turbulence level, were made. The cascade and instrumentation are shown to have advantages both in cost and effectiveness over continuous running cascades. Author (ESA)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N78-13088*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ASSESS 2: SPACELAB SIMULATION. EXECUTIVE SUMMARY
Jul. 1977 48 p refs Prepared in cooperation with ESA, Paris
(NASA-TM-78444; A-7229; ESA-SL(77)1) Avail: NTIS HC A03/MF A01 CSCL 22A

An Airborne Science/Spacelab Experiments System Simulation (ASSESS II) mission, was conducted with the CV-990 airborne laboratory in May 1977. The project studied the full range of Spacelab-type activities including management interactions, experiment selection and funding, hardware development, payload integration and checkout, mission specialist and payload specialist selection and training, mission control center payload operations control center arrangements and interactions, real time interaction during flight between principal investigators and the flight crew, and retrieval of scientific flight data. ESA established an integration and coordination center for the ESA portion of the payload as planned for Spacelab. A strongly realistic Spacelab mission was conducted on the CV-990 aircraft. U.S. and ESA scientific experiments were integrated into a payload and flown over a 10 day period, with the payload flight crew fully-confined to represent a Spacelab mission. Specific conclusions for Spacelab planning are presented along with a brief explanation of each.
Author

N78-13089*# Norden, Norwalk, Conn.
LASER SPACE RENDEZVOUS AND DOCKING SYSTEM STUDY CONTINUATION Final Report, Feb. 1976 - Jun. 1977
S. Adelman, H. Heynau, S. Levinson, and F. Weindling 30 Jun. 1977 70 p
(Contract NAS8-31489)
(NASA-CR-150478; Rept-1257-R-0013) Avail: NTIS HC A04/MF A01 CSCL 22A

Investigations were made of a configuration for a spaceborne laser radar (ladar) to meet the requirements for rendezvous and docking with a cooperative object in synchronous orbit. An analysis was completed of laser phase locking techniques, while experimental verification was made of pulse repetition frequency and resonant scanning control loops. Data measurements on a satellite mock-up were also made. The investigation supports the original contention that a rendezvous and docking ladar can be configured to offer a cost effective and reliable solution to envisioned space missions. Author

N78-13090*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MIXING OF TWO LIQUID METALS ON SPAR PAYLOAD DUE TO SPIN-UP AND SPIN-DOWN
Charles F. Schafer Oct. 1977 22 p refs
(NASA-TM-78144) Avail: NTIS HC A02/MF A01 CSCL 11F

Unexpected results from SPAR experiments, directed at obtaining fine dispersions of metal systems that in a 1-g environment tend to segregate very rapidly, were considered. The physical processes occurring in fluid samples, such as the SPAR samples before solidification, were shown to be insufficient to produce a well mixed liquid by the time solidification was initiated. This would result in solidified samples with the type of segregation noted in the SPAR samples. Experimental evidence and analytical arguments are presented. Author

N78-13091# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PARADOXES OF COSMIC FLIGHTS
Ary Sztemfeld 26 Apr. 1977 23 p refs Transl. into ENGLISH from Astronautyka (Poland), no. 5 (87), 1976 p 4-9
(AD-A045070; FTD-ID(RS)I-0469-77) Avail: NTIS HC A02/MF A01 CSCL 22/3

The author discusses several seemingly paradoxical phenomena occurring in space flight. These paradoxes are concerned with the magnitude of gravity at perigee, apogee, perihelion and aphelion. He examines the physics behind the phenomena and provides mathematical explanations which show that one can more easily penetrate onto a heavenly body from the apocentrum of the circulating orbit surrounding it--i.e. from the most distant point from it--than from the closest point--the pericentrum. Moreover, from the point of the earth's orbit closest to the sun--the perihelion, where the force of gravitational attraction of this star is greatest--one can more easily extricate himself beyond the solar system than from the aphelion, i.e. when the earth is most distant from it. GRA

N78-13092# European Space Agency, Paris (France).
[ACTIVITIES OF THE EUROPEAN SPACE AGENCY] Annual Report, 1976
1977 204 p refs
Avail: NTIS HC A10/MF A01

No ESA satellite was launched during 1976, however, activities were deployed in the preparation of five launchings scheduled for 1977. Satellites to be launched are GEOS, IUE, ISEE, Meteosat, and OTS. The status of the development program for further scientific, meteorological, and communications satellite launches is described as well as those for Spacelab and the Ariane launcher. Future programs are outlined and technological and scientific research activities are reported. Satellite operations and data processing activities are described including those at the Space Documentation Service. Ground facilities are reviewed and the organization and structure of ESA are outlined. External relations are reported. ESA

N78-13093# Battelle Inst., Frankfurt am Main (West Germany).
STUDY ON ACOUSTICAL MIXING AND POSITIONING OF MOLTEN MATERIALS IN SPACE, PHASE 3
E. G. Lierke and W. M. Heide Paris ESA Jul. 1977 115 p refs
(Contract ESA-2678/76-F-WMT(SC))
(BF-R-63.052-1; ESA-CR(P)-991) Avail: NTIS HC A06/MF A01

Hardware and experimental investigations for optimum design and for demonstrating the feasibility and capability of an ultrasonic mixing system for use onboard Spacelab are described, together with the final design of a related positioning system. The mixing system incorporates a cartridge providing direct contact between the active acoustic tool (transmitter) and the fluid matrix which is limited to a small quantity of approximately 50 milliliters for the first missions. The positioning system consists of a cylindrical tube levitator. Effects discovered with this system during experimental investigations are reviewed. ESA

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N78-13094# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
SCENE CONTENT ANALYSIS PROGRAM, PHASE 2 Final Report, 7 Jul. 1976 - 15 Jul. 1977
Ernest L. Hall, Werner Frei, and Robert Y. Wong 15 Jul. 1977 279 p refs
(Contract F04701-76-C-0224)
(AD-A045624; SAMSO-TR-77-87) Avail: NTIS HC A13/MF A01 CSCL 17/7

This report summarizes the development of map matching techniques for precision guided reentry vehicles using measurements extracted from data taken by sensors with different operating characteristics and under different viewing geometries. The case of matching optical to side looking radar images is considered in detail. Map matching with hierarchical search was developed and practical algorithms implemented in matching scenes with a wide variety of contents. Theoretical analyses, which were subsequently verified by experiment, indicated that applications of this method have made the difficult task of optical to radar map matching possible at a computational efficiency of 3 orders in magnitude higher than current map matching methods. Map matching with this method has also resulted in a high probability of a match at a relatively low probability of false fix. Also included are analyses to determine perspective, scaling and rotational parameters from data extracted from image set. Geometric transformation for the correction of viewing geometry can be made using these parameters. Intensity transformation using sensor-dependent parameters was also developed. Practical algorithms were implemented for the corrections of the intensity of several sets of radar images. GRA

N78-13095# Hatfield Polytechnic (England). Numerical Optimisation Centre.
THE OPTIMISATION OF SATELLITE TRAJECTORIES. VOLUME 1: STUDY REPORT
J. J. Pocha, S. E. Hersom, L. C. W. Dixon, and M. C. Bartholomew-Biggs Paris ESA Aug. 1977 90 p refs Prepared for HSD 3 Vol.
(Contract ESOC-764/75-AR-SC)
(HSD-TP-7633-Vol-1; ESA-CR(P)-996-Vol-1) Avail: NTIS HC A05/MF A01

The applicability of optimization techniques to the problems of optimally manueuvering spacecraft in orbit was investigated. Seven simplified, but realistic, test missions were considered, having in-trajectory as well as end constraints. Where a problem could be readily specified as the determination of a comparatively small number of variables, a direct approach was adopted, but where some of the variables were essentially continuously variable a hybrid method was used which combined the techniques of both direct and indirect methods. This technique was shown to be effective even with a singular arc problem in optimal control. Author (ESA)

N78-13096# Hatfield Polytechnic (England). Numerical Optimisation Centre.
THE OPTIMISATION OF SATELLITE TRAJECTORIES. VOLUME 2: THEORY
S. E. Hersom, L. C. W. Dixon, and M. C. Bartholomew-Biggs Paris ESA Jun. 1977 46 p refs Prepared for HSD 3 Vol.
(Contract ESOC-764/75-AR-SC)
(HSD-TP-7633-Vol-2; ESA-CR(P)-996-Vol-2) Avail: NTIS HC A03/MF A01

The theoretical aspects of the optimization of a series of satellite missions are described. Transformations are introduced

which enable all these missions to be posed as standard nonlinear programming problems in a small number of variables. The missions described include cases with continuously variable thrust angles, true anomaly and cone constraints, and rate constraints which imply the singular arc case. Author (ESA)

N78-13097# Hatfield Polytechnic (England). Numerical Optimisation Centre.
THE OPTIMISATION OF SATELLITE TRAJECTORIES. VOLUME 3: PROGRAMME DESCRIPTION AND USERS' GUIDE
M. C. Bartholomew-Biggs Paris ESA Aug. 1977 157 p Prepared for HSD 3 Vol.
(Contract ESOC-764/75-AR-SC)
(HSD-TP-7633-Vol-3; ESA-CR(P)-996-Vol-3) Avail: NTIS HC A08/MF A01

The programs produced are described, and details of program structure, input, and output are presented. The derivation of the equations used in the programs is also given. Sample data files and output listings are provided. Subroutine-level flowcharts are supplied to illustrate the layout of the software. Author (ESA)

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N78-13098# Range Commanders Council, White Sands Missile Range, N. Mex. Documentation Group.
UNIVERSAL DOCUMENTATION SYSTEM. VOLUME 1: SYSTEM DESCRIPTION, PROGRAM INTRODUCTION AND STATEMENT OF CAPABILITY
Jun. 1977 89 p refs Supersedes DG-501-72
(AD-A045355; DG-501-70-Vol-1; DG-501-72) Avail: NTIS HC A05/MF A01 CSCL 16/1

This handbook describes the Universal Documentation System (UDS) which is used to formally document user agency test program support requirements and support agency capabilities and commitments to support those requirements. This handbook is published in two volumes. Volume 1 describes the total UDS structure, the individual documents within the system, and the use and control of the system. Volume 1 also includes sample forms and specific instructions for the Program Introduction and Statement of Capability documents which are the first level of UDS documents. Volume 2 contains sample forms and instructions for the more detailed documents in the UDS. UDS provides a common language and format for stating requirements and preparing support responses. It encompasses documentation generated by user agencies which state program, mission, or test requirements, and those response documents generated by the support agencies to define the support to be provided. GRA

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N78-13099*# Boeing Aerospace Co., Seattle, Wash. Space Div.
SOLAR POWER SATELLITE: SYSTEM DEFINITION STUDY. PART 1, VOLUME 1: EXECUTIVE SUMMARY
28 Jun. 1977 32 p
(Contract NAS9-15196)
(NASA-CR-151554; D180-20689-1-Pt-1-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 22B

A study of the solar power satellite system, which represents a means of tapping baseload electric utility power from the sun on a large scale, was summarized. Study objectives, approach, and planning are presented along with an energy conversion evaluation. Basic requirements were considered in regard to space transportation, construction, and maintainability. B.L.P.

N78-13100*# Boeing Aerospace Co., Seattle, Wash. Space Div.
SOLAR POWER SATELLITE. SYSTEM DEFINITION STUDY. PART 1, VOLUME 2: SYSTEM REQUIREMENTS AND ENERGY CONVERSION OPTIONS
29 Jul. 1977 344 p refs
(Contract NAS9-15196)
(NASA-CR-151555; D180-20689-2-Pt-1-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 22B

Propulsion system requirements for point of departure and earth-to-orbit, or orbit-to-orbit transportation are discussed. The solar photovoltaic and thermal engine configurations are analyzed. A.R.H.

N78-13101*# Boeing Aerospace Co., Seattle, Wash. Space Div.
SOLAR POWER SATELLITE. SYSTEM DEFINITION STUDY. PART 1, VOLUME 3: CONSTRUCTION, TRANSPORTATION AND COST ANALYSES
8 Aug. 1977 278 p
(Contract NAS9-15196)
(NASA-CR-151556; D180-20689-3-Pt-1-Vol-3) Avail: NTIS HC A13/MF A01 CSCL 22B

Concepts developed for both LEO and GEO construction of photovoltaic and thermal engine satellites are analyzed. Topics discussed include: satellite construction; crew scheduling; crew jobs and organizations; operator productivity rating; constructability rating; transportation systems for cargo launch, refueling operations, personnel transport, and orbit transfer; collision analysis, cost analysis, and radiation environment and effects. A.R.H.

N78-13102*# Boeing Aerospace Co., Seattle, Wash. Space Div.
SOLAR POWER SATELLITE. SYSTEM DEFINITION STUDY. PART 1, VOLUME 4: SPS TRANSPORTATION SYSTEM REQUIREMENTS
1 Aug. 1977 48 p
(Contract NAS9-15196)
(NASA-CR-151557; D180-20689-4-Pt-1-Vol-4) Avail: NTIS HC A03/MF A01 CSCL 22B

The best estimates of space transportation requirements for cargo launch vehicles, personnel launch carriers, high thrust orbit transfer, and electric orbit transfer systems are discussed, along with the rationale for each. A.R.H.

N78-13103*# Boeing Aerospace Co., Seattle, Wash. Space Div.
SOLAR POWER SATELLITE. SYSTEM DEFINITION STUDY. PART 1, VOLUME 5: SPS TRANSPORTATION. REPRESENTATIVE SYSTEM DESCRIPTIONS
28 Jul. 1977 253 p
(Contract NAS9-15196)
(NASA-CR-151558; D180-20689-5-Pt-1-Vol-5) Avail: NTIS HC A12/MF A01 CSCL 22B

Both LEO transportation (earth to low earth orbit) and GEO transportation (low earth orbit to geosynchronous orbit) segments were addressed. LEO options include both a 2 stage winged space freighter vehicle and a 2 stage ballistic recoverable vehicle. Both incorporate LO(2)/RP-1/LH(2) engines on the booster and standard SSME's on the upper stage. The orbit transfer vehicle options included chemical for geosynchronous satellite assembly and self powered electric propulsion for low earth orbit satellite assembly. An exhaust products analysis was conducted for the earth to LEO vehicle since atmospheric pollution could be a concern. Author

N78-13104*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE SITUATION REPORT, VOLUME 17, NUMBER 5
31 Oct. 1977 42 p
(NASA-TM-74745) Avail: NTIS HC A03/MF A01 CSCL 22A

Space objects in orbit are listed as well as those which decayed during this reporting period. Data provided include international designation and catalog number, nation of source, launch data, inclination, apogee and perigee. Transmitting frequencies for satellites being monitored by NASA space flight tracking and data network are given. Author

N78-13105*# Boeing Aerospace Co., Huntsville, Ala.
SIMPLIFIED THERMAL ESTIMATION TECHNIQUES FOR LARGE SPACE STRUCTURES
E. W. Brogren, D. L. Barclay, and J. W. Straayer Oct. 1977 119 p refs
(Contract NAS1-13967)
(NASA-CR-145253; D180-19334-2) Avail: NTIS HC A06/MF A01 CSCL 22B

A tool for making rapid estimates of the response of space structures to thermal environments encountered in earth orbits is provided for the designer of these structures. Charts giving heating rates and temperatures for certain typical large spacecraft structural elements are provided. Background information for spacecraft thermal design considerations is presented. Environments, requirements, thermal control techniques, design guidelines, and approaches available for more detailed thermal response analysis are discussed. Author

N78-13106*# Varian Associates, Palo Alto, Calif.
SOLAR POWER SATELLITE 50 kW VKS-7773 cw KLYSTRON EVALUATION Final Report, 15 Jan. - 15 May 1977
A. D. LaRue Aug. 1977 62 p
(Contract NAS9-15176)
(NASA-CR-151577) Avail: NTIS HC A04/MF A01 CSCL 22B

A test program for evaluating the electrical characteristics of a cw, 50 kW power output klystron at 2.45 GHz is described. The tube tested was an 8-cavity klystron, the VKS-7773 which had been in storage for seven years. Tests included preliminary testing of the tube, cold tests of microwave components, tests of the electromagnet, and first and second hot tests of the tube. During the second hot test, the tuner in the fifth cavity went down to air, preventing any further testing. Cause of failure is not known, and recommendations are to repair and modify the tube, then proceed with testing as before to meet program objectives. Author

N78-13107*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CTS (HERMES): UNITED STATES EXPERIMENTS AND OPERATIONS SUMMARY
Patrick L. Donoughe and Henry R. Hunczak 1977 27 p refs Presented at Symp. on Hermes (Communications Technol. Satellite), its Performance and Applications, Ottawa, 29 Nov. 1 Dec. 1977; sponsored by Royal Soc. of Canada, Canadian Dept. of Communications and NASA
(NASA-TM-73830) Avail: NTIS HC A03/MF A01 CSCL 22A

The Communications Technology Satellite, launched in January 1976 and embodying the highest power transmitter in a communications satellite, was considered. As a joint program between the U.S. and Canada, close coordination of the two countries was necessitated since the management and control of experiments were done in real time. Criteria used by NASA for acceptance of the United States experiments are noted and acceptance procedures are discussed. The category for each accepted experiment is given. The modus operandi employed for the U.S. experiments in the areas of management, coordination, liaison, and real time operation are described. Some of the highlights associated with satellite utilization are given. Author

N78-13108*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TERRESTRIAL ENVIRONMENT (CLIMATIC) CRITERIA GUIDELINES FOR USE IN AEROSPACE VEHICLE DEVELOPMENT, 1977 REVISION
John W. Kaufman, ed. Nov. 1977 531 p refs Revised
(NASA-TM-78118; M-234) Avail: NTIS HC A23/MF A01 CSCL 22B

Guidelines are provided on terrestrial environment data specifically applicable for NASA aerospace vehicles and associated equipment development. Information is included on the general distribution of natural environment extremes in the conterminous United States that may be needed to specify design criteria in the transportation of space vehicle subsystems and components. Atmospheric attenuation was investigated since certain earth orbital experiment missions are influenced by the earth's atmosphere. A summary of climatic extremes for worldwide operational needs is also included. The latest available information on probable climatic extremes is presented with information on atmospheric chemistry, seismic criteria, and on a mathematical model to predict atmospheric dispersion of aerospace engine exhaust cloud rise and growth. Cloud phenomena are also considered. Author

N78-13109*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF PROPULSION SYSTEM CHARACTERISTICS ON ASCENT PERFORMANCE OF DUAL-FUELED SINGLE-STAGE EARTH-TO-ORBIT TRANSPORTS
John J. Rehder Dec. 1977 65 p refs
(NASA-TP-1115; L-11933) Avail: NTIS HC A04/MF A01 CSCL 21H

The results of a parametric study of ascent performance are presented for a vertical take off, horizontal landing, single stage earth-to-orbit transport vehicle. Two dual fueled concepts, series burn and parallel burn, were investigated, both of which utilized dual position rocket nozzles. The analysis was made by systematically varying a set of propulsion similarity parameters, initial thrust-weight ratio, the proportion of the thrust due to dual position nozzle engines, expansion ratios of the rocket nozzle, and the relative split between the two fuels, hydrogen and hydrocarbon. The data are presented as a series of curves of mass ratio plotted against each of the similarity parameters for various combinations of the other similarity parameters. Author

N78-13110*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FIRE PROTECTION COVERING FOR SMALL DIAMETER MISSILES Patent Application
Salvatore R. Riccitiello and Paul M. Sanko, inventors (to NASA) Filed 25 Nov. 1977 19 p
(NASA-Case-ARC-11104-1; US-Patent-Appl-SN-854920) Avail: NTIS HC A02/MF A01 CSCL 16D

Intumescent protection sheeting of unusually uniform thickness was prepared from epoxy polysulfide compositions containing microfibers and the ammonium salt of 1,4-nitroaniline-2-sulfonic acid. An ammonium salt particle size in the order of 5 to 8 microns and a fiber size of about 1/128th inch in length and 3 to 5 microns in diameter was found critical to obtain the required density of 1.46 to 1.50 g/cc. The insulation sheeting was prepared by a continuous process involving vacuum mixing, calendering, and curing under very strict conditions which depend to some extent upon the thickness of the sheet produced. The resulting flexible sheet can be wrapped easily and tightly around small diameter missiles, thus affording them for the first time, protection from fire for at least 5 minutes. The material is also suited for the protection of other articles with convoluted or contoured surfaces, which require covering of highly uniform thickness. NASA

N78-13111# Tactical Air Warfare Center, Eglin AFB, Fla.
COMBAT ECHO WEAPON SYSTEM EVALUATION PROGRAM. F-4/AIM-7/AIM-9E SEQUENTIAL ATTACK PROFILE IN AN ECM ENVIRONMENT
Jun. 1977 11 p
(AD-A045271) Avail: NTIS HC A02/MF A01 CSCL 16/4

Employment Concept. F-4/AIM-7E and F-4/AIM-9 profiles will be flown in conjunction with one another, as they are viable operational employment concepts against targets representative of the threat based on the following: AIM-7. Launches of the AIM-7 are recommended with the radar in full auto-track mode as would be the optimum launch condition used in an operational environment. However, in an ECM environment the shooter would be required to convert to the stern area and accept an AIM-7 launch at less than optimum firing conditions. Depending upon the type of ECM encountered, the AIM-7 may have to be launched in HOJ, AOJ, boresight or manual track. These alternate firing modes tax the aircrew to the utmost and demand a complete

knowledge of the fire control system. Firing in a jamming environment also provides an excellent training opportunity for participating aircrews. AIM-9. Launching the AIM-9 in the caged condition is the optimum mode for end-game performance. GRA

N78-13112# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INITIATION OF VENERA
N. Yevgenyev 12 May 1977 10 p Transl. into ENGLISH from Pravda (USSR), no. 147(18560), 27 May 1969 p 1-3
(AD-A045074; FTD-ID(RS)I-0566-77) Avail: NTIS HC A02/MF A01 CSCL 22/2

This article describes the preparations and tests carried out before the flights of the Soviet space probes Venera 5 and Venera 6. GRA

N78-13113# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md. Applied Physics Lab.
THE EFFECT OF WGS-72 GEOPOTENTIAL IN THE NAVY NAVIGATION SATELLITE SYSTEM ON STATION SURVEYS
B. B. Holland, A. Eisner, and S. M. Yionoulis Aug. 1977 36 p refs
(Contract N00017-72-C-4401)
(AD-A045513; APL/JHU/TG-1311) Avail: NTIS HC A03/MF A01 CSCL 08/5

To impart greater internal consistency to the Transit System, the WGS-72 geopotential was implemented in the Navy Navigation Satellite System in December 1975. Sites previously surveyed using Transit (APL 4.5 geopotential) exhibit shifts in their surveyed positions that depend on their geographic location. The shifts result because the satellite ephemerides are displaced by varying amounts dependent on their earth-fixed subtrack. The amount and character of the ephemeris and site shifts were investigated for four satellites and 16 receiving stations. Noting the dependence of the station position shifts on ephemeris differences when using the two different geopotential models (APL 4.5 versus WGS-72), a scheme was developed to produce an estimate of survey shifts that would be expected on a worldwide grid. The shifts exhibit a worldwide rms of about 4 m and reach a maximum of 15 m in the Indian Ocean area. The results presented include real data surveys at the TRANET and OPNET stations and the simulated surveys. Author (GRA)

N78-13114# European Space Agency, Paris (France).
SOME INVESTIGATIONS ON MISSILES USING A SPIKE FOR AERODYNAMIC CONTROL AT HIGH MACH NUMBERS
Wolfgang Wyborny Oct. 1977 31 p refs Transl. into ENGLISH of 'Einige Untersuch. an Flugkoerpern mit Zentralstift als Steuerorgan bei hohen Machzahlen', DFVLR, Cologne Report DLR-FB-77-03, 3 Feb. 1977 Original report in GERMAN previously announced as N77-29194 Original German report available from DFVLR, Cologne DM 15
(ESA-TT-410; DLR-FB-77-03) Avail: NTIS HC A03/MF A01

Missiles of a length of 7.5 calibers with stabilizing at the tail and different nose shapes were tested in a gun tunnel at Mach number 8.8. The main purpose was to investigate the possibility of aerodynamic control of such missiles by means of a deflected spike. By simple estimations the order of magnitude of the maximum normal force created by a deflected spike can be calculated for different nose shapes. Author (ESA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N78-13115# TRW Defense and Space Systems Group, Redondo Beach, Calif.
DEPARTMENT OF DEFENSE SPACE TRANSPORTATION SYSTEM (DOD/STS) MISSION OPERATIONS DESIGN MISSION A Final Report, 1 Oct. 1976 - Sep. 1977
G. S. Gedeon, J. R. Owen, and R. D. Tomlinson Sep. 1977 291 p
(Contract F04701-75-C-0025)
(AD-A045100; TRW-26937-6136-TU-00; SAMSO-TR-77-116)
Avail: NTIS HC A13/MF A01 CSCL 22/3

This report presents the results of analysis of a near term DOD geosynchronous near equatorial payload deployment mission utilizing the Space Shuttle Vehicle, in conjunction with an Interim Upper Stage (IUS). This issue of the report concentrates on development of a nominal mission plan for a particular launch date and time. Such items as attitude timelines, approximate RCS/OMS propellant utilization histories, ground tracks, and ground station coverage timelines are included. Principal emphasis is placed on development of an IUS deployment timeline for near term missions. Author (GRA)

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N78-13116# Los Alamos Scientific Lab., N. Mex.
DESCRIPTION OF A PASSIVE TEMPERATURE TELEMETRY SYSTEM
R. E. Bobbett, A. R. Koelle, J. A. Landt, and S. W. Depp Feb. 1977 14 p refs
(Contract W-7405-eng-36)
(LA-6725-MS) Avail: NTIS HC A02/MF A01

An electronic temperature monitoring sytem is described. The system was designed and fabricated to demonstrate the feasibility of monitoring the temperature of a bovine animal via a passively powered transponder implanted under the animal's skin. The functional elements comprising this successful pre-prototype system are documented. ERA

N78-13117# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Hamburg (West Germany).
TELEMETRY METHOD FOR MEASUREMENT OF BODY TEMPERATURES OF SEVERAL PERSONS OVER LONGER PERIODS [TELEMETRISCHES VERFAHREN ZUR MESSUNG DER KOERPERTEMPERATUREN BEI MEHREREN PERSONEN UEBER LAENGERE ZEITRAEUME]
H. Hohlweck 1975 11 p In GERMAN
(DLR-IB-355-75-09) Avail: NTIS HC A02/MF A01

Equipment for telemetry of the body temperature of several persons is described. It consists of a resistance temperature sensor, a battery-fed FM transmitter, and a clock, switching the transmitter on at 20 min intervals for a duration of 2 min. Each test person is identified by transmission of a characteristic frequency prior to the telemetry data. The temperature transducer voltage level is used for modulating the FM carrier. ESA

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N78-13118*# Sigma corp., Houston Tex.
DEVELOPMENT OF THE ENGINEERING DESIGN INTEGRATION (EDIN) SYSTEM: A COMPUTER AIDED DESIGN DEVELOPMENT Final Report
C. R. Glatt and G. N. Hirsch Aug. 1977 67 p refs
(Contract NAS9-14520)

(NASA-CR-151568; TN-77-0810) Avail: NTIS HC A04/MF A01 CSCL 22A

The EDIN (Engineering Design Integration) System which provides a collection of hardware and software, enabling the engineer to perform man-in-the-loop interactive evaluation of aerospace vehicle concepts, was considered. Study efforts were concentrated in the following areas: (1) integration of hardware with the Univac Exec 8 System; (2) development of interactive software for the EDIN System; (3) upgrading of the EDIN technology module library to an interactive status; (4) verification of the soundness of the developing EDIN System; (5) support of NASA in design analysis studies using the EDIN System; (6) provide training and documentation in the use of the EDIN System; and (7) provide an implementation plan for the next phase of development and recommendations for meeting long range objectives. Author

N78-13119*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

ENTRY DYNAMICS OF SPACE SHUTTLE ORBITER WITH LATERAL-DIRECTIONAL STABILITY AND CONTROL UNCERTAINTIES AT SUPERSONIC AND HYPERSONIC SPEEDS

Howard W. Stone and Richard W. Powell Dec. 1977 103 p refs

(NASA-TP-1011; L-11112) Avail: NTIS HC A06/MF A01 CSCL 22A

A six-degree-of-freedom simulation analysis was conducted to examine the effects of the lateral-directional static aerodynamic stability and control uncertainties on the performance of the automatic (no manual inputs) entry-guidance and control systems of the space shuttle orbiter. To establish the acceptable boundaries of the uncertainties, the static aerodynamic characteristics were varied either by applying a multiplier to the aerodynamic parameter or by adding an increment. Control-system modifications were identified that decrease the sensitivity to off-nominal aerodynamics. With these modifications, the acceptable aerodynamic boundaries were determined. Author

N78-13120# Oxford Univ. (England). Engineering Lab.

STABILITY AND CONTROL OF FLEXIBLE SPACECRAFT WITH PARAMETRIC EXCITATION

C. J. Harris Apr. 1977 22 p refs

(OUEL-1193/77) Avail: NTIS HC A02/MF A01

The analysis and control of flexible spacecraft has attracted considerable attention in recent years; with ever increasing demands for fine pointing accuracy and larger and more complex vehicles, this problem is becoming more significant. The lumped parameter modeling approach is used to find a simple but representative three-dimensional mathematical model of a generalized flexible satellite with momentum exchange and body fixed gas jet reactor attitude controllers. It is shown, by way of an example of the geomagnetic field, that external disturbances can lead to parametric excitation of spacecraft models. Also, inadequacy of modeling through lack of physical insight or lack of data will lead to the same phenomena. Solution to the essential problems of stability, state estimation, and sub-optimal control of flexible satellites modeled with parametric variations of a stochastic nature are given. These techniques are of a very general structure and are applicable to any dynamic system modeled by linear multivariable Ito stochastic differential equations.

Author (ESA)

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N78-13121# European Space Agency, Paris (France).

ORBITAL TESTS OF THE CACTUS ACCELEROMETER

Michel Delattre, Jacques Beaussier, Alain Bernard, Jean-Louis Boulay, Jacques Bouttes, Jean Fave, Michel Gay, Jean-Pierre Guibert, Remy Juillerat, Pierre Laroche et al Oct. 1977 148 p refs Transl. into ENGLISH of 'Les Essais en Orbite de l'Accelerometre CACTUS', ONERA, Paris Report ONERA-P-1976-5, 1976 Original report in FRENCH previously announced as N77-32228

(ESA-TT-424; ONERA-P-1976-5) Avail: NTIS HC A07/MF A01

The CACTUS accelerometer (French acronym meaning ultrasensitive, three-axis, capacitive accelerometric transducer) was developed at ONERA with a view to utilization in space experiments. Its measuring range is between 10 to the minus 8th power and 10 to the minus 4th power m/sec sq. The French satellite CASTOR, designed and placed in orbit by CNES (the French Space Agency) on May 17, 1975, had as primary objective the qualification in flight of the CACTUS accelerometer. After a brief historical account and a general presentation, the instrument, its means of calibration on the ground and in space, an analysis of causes of perturbations, and the corresponding verifications performed in orbit, as well as detailed results of the qualification experiments are described in detail. It appears evident that the resolution of the instrument is 2.10 to the minus 9th power m/sec sq. Author (ESA)

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N78-13122*# Systems Science and Software, La Jolla, Calif.

SOLAR ELECTRIC PROPULSION THRUSTER INTERACTIONS WITH SOLAR ARRAYS Contractor Report, Jul. 1976 - Jul. 1977

Donald E. Parks and Ira Katz Aug. 1977 258 p refs

(Contract NAS3-20119)

(NASA-CR-135257; SSS-R-78-3420) Avail: NTIS HC A12/MF A01 CSCL 21C

The effect of interactions of spacecraft-generated and naturally occurring plasmas with high voltage solar array components on an advanced solar electric propulsion system proposed for the Halley's Comet rendezvous mission was investigated. The spacecraft-generated plasma consists of mercury ions and neutralizing electrons resulting from the operation of ion thrusters (the charge-exchange plasma) and associated hollow cathode neutralizers. Quantitative results are given for the parasitic currents and power coupled into solar arrays with voltage fixed as a function of position on the array. Author

N78-13123*# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.

CHARGE-EXCHANGE PLASMA GENERATED BY AN ION THRUSTER Annual Report 1 Nov. 1976 - 31 Dec. 1977

Harold R. Kaufman Dec. 1977 41 p refs

(Grant NsG-3038)

(NASA-CR-135318) Avail: NTIS HC A03/MF A01 CSCL 21C

The charge exchange plasma generated by an ion thruster was investigated experimentally using both 5 cm and 15 cm thrusters. Results are shown for wide ranges of radial distance from the thruster and angle from the beam direction. Considerations of test environment, as well as distance from the thruster, indicate that a valid simulation of a thruster on a spacecraft was obtained. A calculation procedure and a sample calculation of charge exchange plasma density and saturation electron current density are included. Author

N78-13124*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

HYDROGEN FILM COOLING OF A SMALL HYDROGEN-OXYGEN THRUST CHAMBER AND ITS EFFECT ON EROSION RATES OF VARIOUS ABLATIVE MATERIALS

Ned Hannum, William E. Roberts, and Louis M. Russell Dec. 1977 27 p refs

(NASA-TP-1098; E-8909) Avail: NTIS

HC A03/MF A01 CSCL 21H

An experimental investigation was conducted to determine what arrangement of film-coolant-injection orifices should be used to decrease the erosion rates of small, high temperature, high pressure ablative thrust chambers without incurring a large penalty in combustion performance. All of the film cooling was supplied through holes in a ring between the outer row of injector elements and the chamber wall. The best arrangement, which had twice the number of holes as there were outer row injection elements, was also the simplest. The performance penalties, presented as a reduction in characteristic exhaust velocity efficiency, were 0.8 and 2.8 percentage points for the 10 and 20 percent cooling flows, respectively. The best film-coolant injector was then used to obtain erosion rates for 19 ablative materials. The throat erosion rate was reduced by a factor of 2.5 with a 10 percent coolant flow. Only the more expensive silica phenolic materials had low enough erosion rates to be considered for use in the nozzle throat. However, some of the cheaper materials might qualify for use in other areas of small nozzles with large throat diameters where the higher erosion rates are more acceptable. Author

N78-13125# Rocketdyne, Canoga Park, Calif.
TARGET ENGINE SYSTEMS Final Report, Sep. 1975 - Mar. 1977
30 Apr. 1977 310 p
(Contract F04611-76-C-0001)
(AD-A045318; RI/RD77-145; AFRPL-TR-77-52) Avail: NTIS HC A14/MF A01 CSCL 21/8

A program to design, fabricate, and test three Target Engine Systems was completed. The designs consisted of flight-proven hardware. The two versions (the low-thrust version employing an RS-14 engine and the high-thrust a modified Atlas vernier) made use of a common design, pressurization, and propellant feed system and structure. Construction utilized a mockup for reference purposes and to reduce program costs. Author (GRA)

N78-13126# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
APPROXIMATE NONLINEAR ANALYSIS OF SOLID ROCKET MOTORS AND T-BURNERS. VOLUME 2: COMPUTER PROGRAM USERS MANUAL Final Report, Feb. 1975 - Jun. 1977
E. A. Powell, M. S. Padmanabhan, and B. T. Zinn Jul. 1977 361 p
(Contract F04611-75-C-0036)
(AD-A045118; AFRPL-TR-77-48-Vol-2) Avail: NTIS HC A16/MF A01 CSCL 21/8

Volume II of this report is a user's manual for the computer programs based on the approximate and 'exact' nonlinear axial-mode combustion instability analyses developed in Volume I. This volume contains a description of all the main programs and subroutines used in these instability programs, as well as descriptions of the inputs needed to operate the programs and the outputs generated. Sample cases are given to facilitate checkout of the programs. The FORTRAN 4 source code for each of the programs is also given. Author (GRA)

N78-13127# Air Force Packaging Evaluation Agency, Wright-Patterson AFB, Ohio.
TEST AND EVALUATION OF AIM 9L/MARK 17 AND 36 ROCKET MOTOR CONTAINER
Edward J. Kowalski Sep. 1977 18 p
(AD-A045787; AFPEA-77-P7-31; PTPD-77-35) Avail: NTIS HC A02/MF A01 CSCL 13/4

One each of AIM 9L/MARK 17 and 36 shipping/storage containers with inert rocket motors were received from HQ ADTC/SDMT, Eglin AFB FL at the Air Force Packaging Evaluation Agency, Wright-Patterson AFB OH. Pressure and rough handling tests were conducted on the containers in accordance with Federal Test Method Standard 101B. Visual inspection indicated no physical damage to the containers upon completion of the tests. Author (GRA)

N78-13128# Societe Europeene de Propulsion, Vernon (France).
FIELD EMISSION ELECTRIC PROPULSION SYSTEM STUDY, VOLUME 1 Final Report
M. Moravie, M. Robert, and D. Valentian Paris ESA 27 Sep. 1977 159 p refs 2 Vol.
(Contract ESTEC-2947/76-NL-AK)
(SEP-TS/L/DV-30.330/77-Vol-1; ESA-CR(P)-998-Vol-1) Avail: NTIS HC A08/MF A01

A technical study and a system study on field emission electric propulsion (FEEP) for a television broadcasting satellite are presented. The technical study covers the design of a lightweight 1 mN laboratory thruster, a long life 2 mN laboratory thruster, the flight model with thruster, tank protective cover, and power conditioning unit. The system study includes a tradeoff between specific impulse and system electric power with a weight evaluation, a compatibility study of FEEP efflux with the satellite and of satellite outgassing with FEEP, and a reliability study with three different system configurations (4 or 8 thrusters with different thrust levels). ESA

N78-13129# Societe Europeene de Propulsion, Vernon (France).
FIELD EMISSION ELECTRIC PROPULSION SYSTEM STUDY, VOLUME 2 Final Report
M. Moravie, M. Robert, and D. Valentian Paris ESA 27 Sep. 1977 118 p refs 2 Vol.
(Contract ESTEC-2947/76-NL-AK)
(SEP-TS/L/DV-30.330/77-Vol-2; ESA-CR(P)-998-Vol-2) Avail: NTIS HC A06/MF A01

A design and development plan, a test plan, and a cost evaluation are presented for a field emission electric propulsion unit of a television broadcasting satellite. The design and development plan reflects the progressive knowledge obtained through the thruster models designed up to the engineering model thruster. Risks are reduced as a result of step-by-step development and the proposal of alternate solutions as a backup. The test plan gives the requirements for each test facility and a preliminary schematic diagram of the electric circuitry. The test philosophy is explained for each thruster. The cost evaluation covers the design, drawing, manufacturing, and test of each thruster up to the engineering model level. ESA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N78-13130# California Univ., Berkeley. Lawrence Berkeley Lab.
ORIGIN OF THE ACENTRIC FACTOR
K. S. Pitzer 1977 19 p refs Presented at Conf. on Estimation and Correlation of Phase Equilibria and Fluid Properties in the Chemical Ind., Pacific, Calif., 16 Jan. 1977
(Contract W-7405-eng-48)
(LBL-5969; CONF-770117-1) Avail: NTIS HC A02/MF A01

Theoretical work on ideal gases was extended to studies of methods for determining the differences in properties of real fluids from their respective ideal gases without extensive experimental studies of each substance. It is noted that the intermolecular forces between complex molecules follow a simple expression in terms of the distances between the various portions of the molecule. The acentric factor is the term used to express consideration of the forces between non-central portions of the molecules. The question of the ultimate accuracy of the acentric factor concept is examined. How accurately do molecules of different shapes but with the same acentric factor really follow corresponding states. Apparently this accuracy is within experimental error for most, if not all, present data. ERA

24 COMPOSITE MATERIALS

Includes laminates.

N78-13131 California Univ., Berkeley.
STRUCTURE AND ELECTRICAL PROPERTIES OF GLASSY CARBON Ph.D. Thesis
Ram Raghuvir Saxena 1976 166 p
Avail: Univ. Microfilms Order No. 77-15849

The structure and electrical properties of Glassy Carbon (GC) were studied using various techniques. Glassy carbon samples were heat treated in a graphite furnace at temperatures in the range 1000-2800 C for different time intervals in order to produce structural changes. Comparison of the K emission bands of graphite, diamond and GC heat treated at different temperatures shows that the experimental observations are best explained in terms of a structure model of GC, which consists of both trigonally and tetrahedrally bonded C atoms, the tetrahedrally bonded C content reducing with heat treatment temperature. Single crystal patterns are seen in transmission electron microscope studies, and a new explanation is proposed to account for these observations. It is proposed that bulk GC does not contain micron size single crystals and that these come about in the process of specimen preparation as built-in stresses are relieved. X-ray techniques were used to characterize the structure of GC. The electrical properties of conductivity and magnetoresistance were studied extensively in this work. Dissert. Abstr.

N78-13132*# Maryland Univ., College Park.
OPTIMUM DESIGN OF STRUCTURES OF COMPOSITE MATERIALS IN RESPONSE TO AERODYNAMIC NOISE AND NOISE TRANSMISSION Final Report
Jackson C. S. Yang and C. Y. Tsui 9 Dec. 1977 48 p refs
(Grant NGR-21-022-350)
(NASA-CR-155332) Avail: NTIS HC A03/MF A01 CSCL 11D

Elastic wave propagation and attenuation in a model fiber matrix was investigated. Damping characteristics in graphite epoxy composite materials were measured. A sound transmission test facility suitable to incorporate into NASA Ames wind tunnel for measurement of transmission loss due to sound generation in boundary layers was constructed. Measurement of transmission loss of graphite epoxy composite panels was also included. Author

N78-13133*# Riggs Engineering Corp., San Diego, Calif.
TECHNICAL ASSESSMENT FOR QUALITY CONTROL OF RESINS Technical Report, 1976 - 1977
Rex B. Gosnell Oct. 1977 132 p refs Prepared for McDonnell-Douglas Astronautics Co., St. Louis, Mo.
(Contract NAS1-12436)
(NASA-CR-145211) Avail: NTIS HC A07/MF A01 CSCL 11G

Survey visits to companies involved in the manufacture and use of graphite-epoxy prepregs were conducted to assess the factors which may contribute to variability in the mechanical properties of graphite-epoxy composites. In particular, the purpose was to assess the contributions of the epoxy resins to variability. Companies represented three segments of the composites industry - aircraft manufacturers, prepreg manufacturers, and epoxy resin manufacturers. Several important sources of performance variability were identified from among the complete spectrum of potential sources which ranged from raw materials to composite test data interpretation. Author

N78-13134*# Westinghouse Electric Corp., Pittsburgh, Pa. Research and Development Center.
CHARACTERIZATION, SHAPING, AND JOINING OF SiC/SUPERALLOY SHEET FOR EXHAUST SYSTEM COMPONENTS Final Report
J. A. Cornie 20 Jul. 1977 82 p refs
(Contract NAS3-19735)
(NASA-CR-135301; Rept-9D4-NASIC-R1) Avail: NTIS HC A05/MF A01 CSCL 11D

Hafnium carbide was shown to be virtually inert when in contact with silicon carbide and Waspaloy for at least 200 hr at 1093 C (2000 F). Extensive interaction was noted with other superalloys such as HA-188. A continuous CVD HfC deposition process was developed for deposition of up to 8 microns on .14 mm (.0056 in.) SiC tungsten core filament at rates as high as .6 m/min. The rate can be increased by increasing the length of the reactor and the output of the power supply used in resistive heating of the filament substrate. The strength of HfC coated filament varies with thickness in a Griffith-like manner. This strength reduction was greater for HfC coatings than for tungsten coatings, presumably because of the greater ductility of tungsten. Author

N78-13135*# Massachusetts Inst. of Tech., Cambridge. Composite Materials and Nondestructive Evaluation Lab.
DYNAMIC FRACTURE OF ADVANCED FIBER COMPOSITES Final Report, Jan. - Dec. 1977
James H. Williams, Jr. Dec. 1977 9 p refs
(Grant NsG-1349)
(NASA-CR-155338) Avail: NTIS HC A02/MF A01 CSCL 11D

Efforts to investigate some of the theoretical bases for the dynamic fracture of graphite fiber reinforced composites are described. In particular, the initiation of unstable fracture in unidirectional cracked composites, dynamic crack propagation as modeled by orthotropic double cantilever beams, and interlaminar stresses for laminates having arbitrary stacking sequences are summarized. Author

N78-13136*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF DISCONTINUITIES AS A MEANS TO ALLEVIATE THERMAL EXPANSION MISMATCH DAMAGE IN LAMINAR COMPOSITES
Charles A. Hoffman Nov. 1977 17 p refs
(NASA-TM-73739; E-9259) Avail: NTIS HC A02/MF A01 CSCL 11D

An investigation of Nichrome/tungsten laminar composites showed that intentionally introduced discontinuities, such as perforations through or grooves on the surface of the matrix laminae, improved thermal expansion mismatch damage resistance. It was found that specimens having smooth matrix laminate surfaces were virtually destroyed by delamination in 21 or fewer fast cool cycles in which they were water quenched from 981 C. Specimens having interior matrix laminae with discontinuities and relatively thin, nondiscontinuous, surface matrix laminae resisted 50 similar cycles without evident delamination damage. Author

N78-13137*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FRACTURE SURFACE CHARACTERISTICS OF OFF-AXIS COMPOSITES
J. H. Sinclair and C. C. Chamis 1977 23 p refs Presented at 14th Ann. Meeting of the Soc. of Engr. Sci., Inc., Bethlehem, Pa., 14-16 Nov. 1977
(NASA-TM-73700; E-9085-2) Avail: NTIS HC A02/MF A01 CSCL 11D

The fracture surface characteristics of off-axis high-modulus graphite-fiber/epoxy composite specimens were studied, using a scanning electron microscope (SEM). The specimens were subjected to tensile loading at various angles (0 deg - 90 deg) to the fiber direction. SEM photomicrographs of the fractured surfaces revealed three different load angle regions with distinct fracture characteristics. Based on these revelations, criteria were established which can be used to characterize fracture surfaces with respect to a predominant single stress fracture mode. Author

N78-13138*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MECHANICAL BEHAVIOR AND FRACTURE CHARACTERISTICS OF OFF-AXIS FIBER COMPOSITES. 1: EXPERIMENTAL INVESTIGATION
John H. Sinclair and Christos C. Chamis Dec. 1977 36 p refs
(NASA-TP-1081; E-9085) Avail: NTIS HC A03/MF A01 CSCL 11D

The mechanical behavior, fracture surfaces, and fracture modes of unidirectional high-modulus graphite-fiber/epoxy composites subjected to off-axis tensile loads were investigated experimentally. The investigation included the generation of stress-strain-to-fracture data and scanning electron microscope studies of the fractured surfaces. The results led to the identification of fracture modes and distinct fracture surface characteristics for off-axis tensile loading. The results also led to the formulation of criteria for identifying and characterizing these fracture modes and their associated fracture surfaces. The results presented and discussed herein were used in the theoretical investigation and comparisons described in Part 2. These results should also provide a good foundation for identifying, characteriz-

ing, and quantifying fracture modes in both off-axis and angle-plied laminates. Author

N78-13139# United Technologies Corp., Windsor Locks, Conn.
DEVELOPMENT OF AIR BONDED FOD RESISTANT METAL MATRIX FAN BLADES
Eugene J. Delgrosso, William J. Fisher, Karl M. Prewo, and Richard D. Veltri Mar. 1977 162 p
(Contract F33615-75-C-5285)
(AD-A045270; AFML-TR-77-13) Avail: NTIS HC A08/MF A01 CSCL 01/3

Advanced Composite aluminum matrix fan blades offer significant payoff to Air Force systems in terms of both cost saving and performance improvements. However, there are currently problems which must be overcome prior to the introduction of such blades to service. Two problem areas have been identified for solution before aluminum matrix composites can be applied to Air Force weapon systems - high cost and inadequate FOD resistance. Low cost bonding fabrication techniques have been identified, and feasibility demonstrated. Improved FOD resistance of boron aluminum composites has been explored on laboratory specimens and full size blades. This program will combine the previously identified solutions to FOD resistance with low cost bonding fabrication to provide a basis for validation of these technologies for future blade hardware. The fabrication approach will be air and 'quick vac' bonding. GRA

N78-13140# McDonnell-Douglas Research Labs., St. Louis, Mo.
THE DURABILITY OF EPOXIES Interim Report, 1 Apr. 1976 - 30 Apr. 1977
R. J. Morgan and J. E. ONeal 1 Aug. 1977 80 p refs
(Contract F44620-76-C-0075)
(AD-A045534; MDC-00631) Avail: NTIS HC A05/MF A01 CSCL 11/9

This report reviews the state of knowledge of the basic factors that control the durability of epoxies in service environments. The structure-property relations of amine (diethylene triamine, DETA)-cured bisphenol-A-diglycidyl ether (DGEBA) and amine (diaminodiphenyl sulfone, DDS)-cured tetraglycidyl 4,4:diaminodiphenyl methane (TGDDM) epoxies, the effects of sorbed moisture, and the fabrication and environmental factors that control the durability of epoxies are reviewed. The modes of deformation and failure of these materials, which occur primarily by crazing, are controlled by their network structure and microvoid characteristics. The pertinent, basic, physical phenomena induced and/or modified by sorbed moisture that affect the durability of epoxies are reviewed. These include the plasticization, swelling stresses, and modification of the crazing process in epoxies caused by sorbed moisture together with the diffusion characteristics of moisture in these materials. The durability of epoxies in service environments are discussed in terms of the structure-property relations of epoxies, the effect of fabrication and environmental factors and their complex interactions on the formation of permanent damage regions. Author (GRA)

N78-13141# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
AN INVESTIGATION OF EDGE DAMAGE DEVELOPMENT IN QUASI-ISOTROPIC GRAPHITE EPOXY LAMINATES Interim Report
David O. Stalnaker and Wayne W. Stinchcomb Sep. 1977 91 p refs
(Contract F33615-75-C-5119)
(AD-A045656; VPI-E-77-24) Avail: NTIS HC A05/MF A01 CSCL 20/11

This investigation describes and documents in detail the initiation, growth, and interactions of damage along the free edges of two types of graphite/epoxy fiber-reinforced composite laminates. The damage is initiated by tensile static loading of flat coupons from each type to three different stress levels. Growth of the damage was caused by tension-tension fatigue loading. The laminates that were investigated differed only by stacking sequence. The observations were made through the use of the replication technique, a method developed for the purpose of this investigation. This technique allows for three-dimensional, instantaneous recordings of the entire specimen edge while it is under maximum load. The recordings or impressions can be studied microscopically and photographed. This method provides for detail and an overall field of vision that has not been obtained in previous studies. The damage development was also monitored by two non-destructive techniques; vibrothermography and an ultrasonic-pulse echo method. GRA

N78-13142# Bendix Corp., Kansas City, Mo.
HIGH TEMPERATURE NONPLANAR LAMINATES
J. D. Stein Mar. 1977 47 p refs
(Contract EY-76-C-04-0613)
(BDX-613-1782) Avail: NTIS HC A03/MF A01

Development of high temperature substrates was initiated to fabricate nonplanar laminates. Forming of readily available polyimide and fluorocarbon films was established, and the evaluation of thermal stability up to 5000 F (260 C) initiated. The development of auxiliary materials suitable for high temperature system applications and specific adhesive evaluation is included. ERA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N78-13143 Rochester Univ., N. Y.
EXCHANGE AND DIPOLAR INTERACTIONS IN SOLID ORGANIC RADICALS Ph.D. Thesis
Chung-Rei Mao 1976 286 p
Avail: Univ. Microfilms Order No. 77-16238

Experimental studies of the electron spin resonance (ESR) line width of various solid organic free radicals of high concentrations were carried out as a function of frequency, temperature, and concentration. The width of the signals is explained with a model involving exchange modulated dipolar interactions. Some of the line widths were found to be temperature dependent, explained by distance and orientation dependent intermolecular electron dipolar and exchange interactions. The exchange energy was found to be temperature dependent and was explained by assuming that it varied with the relative distance and angle between the p orbitals on adjacent molecules. Using appropriate distances and angles between atoms in the empirical formula, it was possible to calculate the exchange energy of the nitroxide radicals. This theoretical exchange energy was used along with experimental values to obtain information on the angular variation of the nitroxide radicals at different temperatures. Dissert. Abstr.

N78-13144 Arizona State Univ., Tempe.
THEORETICAL INVESTIGATIONS OF SPECTRAL LINE-SHAPES AND OVERLAPS IN ATOMIC ABSORPTION SPECTROMETRY Ph.D. Thesis
Raymond Joseph Lovett 1977 274 p
Avail: Univ. Microfilms Order No. 77-17393

Use of a speed dependent modified Voigt profile revealed that the linewidths of light elements are grossly different compared to the Voigt profile. Differences in a-parameter values as calculated by the two functions were as large as 80% for Li. For heavier elements the deviation is much smaller. Use of semiclassical theory allowed the estimation of spectral transition a-parameter values to be made. Discrepancies from experimentally determined a-parameter values were generally less than + or - 20% for all but transition elements. Values for 113 transitions of 32 elements were calculated. In addition a method for estimating the full width at half maximum intensity of a hyperfine broadened line was developed which was accurate to + or - 15%. Investigations of spectral overlaps revealed that the ratio of the overlap absorbance to the absorbance using the analyte source line was extremely dependent on the a-parameter value of the absorption coefficient profile. Dissert. Abstr.

N78-13145 Missouri Univ., Columbia.
THE GAS AND LIQUID CHROMATOGRAPHY OF METAL CHELATES Ph.D. Thesis

Thomas Patrick OBrien 1976 191 p
Avail: Univ. Microfilms Order No. 77-15542

The use of an atomic absorption (AA) spectrophotometer as a substance selective detector for gas chromatography was investigated and found to have the excellent possibility of being used as a detector in gas chromatographic (GC) analysis when a metal specific detector is needed. The hexafluoroacetylacetonate-di-n-butylsulfoxide complexes of Ni(II), Co(II), Fe(II), Fe(III), Mn(II), Cu(II), Zn(II) and Cr(III) were studied with this GC-AA method. The liquid chromatographic behavior of several metal complexes was determined. The metal complexes were chromatographed on several types of column packing material utilizing several different mobile phases to obtain the best response characteristics. It was found that thin-layer chromatographic studies cannot always be transferred directly to liquid chromatography with the same results even when the same chromatographic material and solvents are used. Dissert. Abstr.

N78-13146 Harvard Univ., Cambridge, Mass.
ACOUSTIC DETECTION AND OTHER NEW FEATURES IN LOW RESOLUTION MICROWAVE SPECTROSCOPY Ph.D. Thesis
Steven John Borchert 1977 292 p
Avail: Univ. Microfilms Order No. 77-17771

New developments in low resolution microwave spectroscopy are described. One technique, which measures the area of a band as a function of the base-to-peak Stark field, is shown to yield a crude estimate of the dipole moment along the a-inertial axis (mu sub a). Based on the results for the 8 to 9 pile-up of benzonitrile, the method obtains a value of mu sub a with approximately a 20 to 30 percent uncertainty. The existence of a new band category, the type - 2, is demonstrated. The characteristics and some possible applications of these pile-ups are discussed. A microwave spectrometer was constructed which utilizes acoustic detection. A simple theory of its signal for rotational spectroscopy is presented. The experimental variables that affect the spectrometer's sensitivity are discussed. A description of improvements in the signal to noise ratio is given together with some suggestions that might result in further increases in the sensitivity. Several possible low resolution applications for the opto-acoustic spectrometer are presented. Dissert. Abstr.

N78-13147 North Carolina Univ., Chapel Hill.
REGRESSION MODEL SOLUTIONS OF VOLTERRA EQUATIONS OF THE FIRST KIND WITH AN APPLICATION TO THE DECONVOLUTION PROBLEM IN PHOTOCHEMISTRY Ph.D. Thesis
Dick Edson Hoskins 1976 340 p
Avail: Univ. Microfilms Order No. 77-17328

Solutions were sought for the Volterra equation which is important in photochemistry; the result is the characteristic decay function. The convolution process is discussed and illustrated with studies on ideal systems. A relationship of the lamp and maximum of the response is derived. The single exponential decay deconvolution is then worked out. The problem is next solved by a linear regression model, however, it was concluded that none of the ordinary linear regression methods would uniformly work on the deconvolution problem. Finally, the linear regression model is solved by singular value decomposition. Selection criteria for the possible solutions are presented. The selection method developed is based on finding the solution nearest a full rank problem. The result is that experimental data can be deconvoluted to give solutions which fit the boundary conditions, are insensitive to small perturbations in the design matrix, and give solutions which statistically are better than a one exponential fit. Dissert. Abstr.

N78-13148 Virginia Polytechnic Inst. and State Univ., Blacksburg.
HIGH EFFICIENCY GAS-SOLID CHROMATOGRAPHIC COLUMNS Ph.D. Thesis
Jerry Marvin Clemons 1977 120 p
Avail: Univ. Microfilms Order No. 77-20230

High efficiency gas chromatographic columns were studied. A micropacked type, having columns with an internal diameter less than 1 mm, had a packing density comparable to conventional packed columns. A slurry packed column consisted of columns which were prepared by using high liquid pressure to rapidly pass a stable suspension of small diameter packing material into the column. This procedure was found to pack small particles more homogeneously and more efficiently, and was found to increase efficiency by as much as five fold. Column diameter, column length, column temperature and sample capacity were also studied in regard to efficiency. Dissert. Abstr.

N78-13149 Cornell Univ., Ithaca, N. Y.
AN EVALUATION OF SILICON VIDICON TUBES AS DETECTORS FOR ATOMIC SPECTROCHEMICAL ANALYSES Ph.D. Thesis
Norman Gary Howell 1976 224 p
Avail: Univ. Microfilms Order No. 77-18878

A multichannel detection system employing silicon vidicon tubes was developed and characterized for application to multiwavelength atomic spectroscopy measurements. The tubes are mounted as detectors on conventional flame spectrometers and evaluated on the basis of their analytical performance. The combination of simultaneous multiwavelength detection and digital multichannel signal processing were shown to provide numerous analytical benefits. The spatial multichannel detection capabilities of the silicon vidicons facilitate simultaneous multielement analyses, internal standard analysis methods, as well as spectral stripping techniques which eliminate practically all spectral interferences. Dissert. Abstr.

N78-13150 Washington Univ., Seattle.
TRACE METAL STUDIES. 1. ATOMIC ABSORPTION DETERMINATION OF VOLATILE METAL HYDRIDES. 2. INORGANIC RAIN CHEMISTRY. 3. METAL SPECIATION IN MARINE SYSTEMS Ph.D. Thesis
Eric Juel Knudson 1976 241 p
Avail: Univ. Microfilms Order No. 77-18374

Arsenic, antimony, bismuth, and selenium were determined in aqueous media by generation of their hydrides using sodium borohydride as the reductant. The technique was applied to determinations of arsenic in salt water, food, and soil samples, and arsenic, antimony, and bismuth in rain samples. Sampling, analytical techniques, mapping, and data analysis techniques applied to single rain storms in the Puget Sound region are discussed. The results indicated at least three major influences on the rain chemistry in the Puget Sound region: (1) a background of sea-salt elements, (2) a large copper smelter located in Tacoma, and (3) urban sources of acidity. A general review of the aspects of metal speciation in natural water systems is presented, including discussions of the possible importance of such speciation to biological and geological availabilities and transport mechanisms, types of metal-organic interactions likely. Dissert. Abstr.

N78-13151 Michigan Univ., Ann Arbor.
FLAME EMISSION SPECTROSCOPY USING UNIFORM SIZED SAMPLE DROPLETS Ph.D. Thesis
Bhanuprasad Mohanlal Joshi 1977 167 p
Avail: Univ. Microfilms Order No. 77-18038

A premixed laminar flow nitrous oxide-acetylene flame using a water-cooled, circular slot burner is described which serves as an excellent atomization and excitation source. The temperature of the flame is measured spectroscopically by an iron two-line method. A detailed diagram of spatial variation of the temperature in the flame is presented. The measured intensity of the analyte species in the flame is resolved in radial intensity values by the Abel inversion procedure in order to determine the spatial distribution of free atoms. Emission profiles for calcium and manganese are presented. The depletion of free atoms due to ionization and compound formation after an analyte particle undergoes complete atomization is observed more predominantly for calcium than for manganese. Dissert. Abstr.

N78-13152 Michigan Univ., Ann Arbor.
RADIATIVE AND ELECTRICAL PROPERTIES OF EXPLODING FOILS AND THEIR APPLICATION TO TRACE METAL ANALYSIS IN MICRO SAMPLE Ph.D. Thesis
Chaur-Sun Ling 1977 229 p
Avail: Univ. Microfilms Order No. 77-18064

The use of the highly luminous metal-vapor plasma obtained from the electrical explosion of metal foils as an excitation source for the analysis of trace metals in micro samples is described.

Sample solutions of metal salts are introduced on the surface of a foil strip. The foil strip is exploded under different conditions with a capacitive discharge. Both photographic and photoelectric detectors were used. Analytical curves and reproducibility data are presented for Cd, Mn, Ni and Pb, both with and without internal reference. The overall reproducibility of these measurements is approximately + or - 10% with an internal reference. Detection limits of 18 elements are also presented which are in the low to sub ng range. Dissert. Abstr.

N78-13153 Oregon State Univ., Corvallis.
EFFECTS OF ATMOSPHERIC PRESSURE ON LINE WIDTHS AND SPATIAL DISTRIBUTIONS OF THE TRANSIENT ATOMIC ABSORPTION SIGNALS OF MINOR CONSTITUENTS IN METAL SAMPLES ATOMIZED BY A DYE LASER MICROPROBE Ph.D. Thesis
Ronald Masao Manabe 1977 156 p
Avail: Univ. Microfilms Order No. 77-20154

Plasma production by a pulsed dye laser was investigated. A photoanodic charge integration apparatus and a short duration hollow cathode was used to obtain atomic absorption measurements in a low pressure plume. The effects of atmospheric pressure on the duration and magnitude of the peak absorption of Mn in a reference steel were studied. Spatially resolved atomic absorption measurements on the plume indicated that the plume was distributed over a much larger volume at low pressure than at atmospheric pressure. Dissert. Abstr.

N78-13154 Michigan State Univ., East Lansing.
AN AUTOMATED, COMPUTER-CONTROLLED STOPPED-FLOW SPECTROPHOTOMETER FOR FAST REACTION-RATE ANALYSIS Ph.D. Thesis
Phillip Kent Notz 1977 207 p
Avail: Univ. Microfilms Order No. 77-18527

A first generation stopped-flow spectrophotometer was improved, automated and interfaced to a PDP 8/e minicomputer. On-line display of results via a high speed CRT terminal provides feedback in seconds after the completion of a stopped-flow experiment. The detection system can achieve a resolution of 1 part in 200,000, which allows the measurement of very small changes in absorbance. Temperature data, with a precision of 0.01 C, can be acquired nearly simultaneously with the acquisition of absorbance data. Investigations reported include rate and equilibrium constants for the iron-thiocyanate reaction, proton consumption by Mo (VI) in a strongly acid solution, dependence of rate of formation of 12- molybdophosphate on nitric acid concentration, and the reaction rates of phosphate and silicate via their reactions with Mo. Dissert. Abstr.

N78-13155 State Univ. of New York, Buffalo.
A STUDY OF NON-EQUIMOLAR TERNARY GAS DIFFUSION Ph.D. Thesis
Ronald Ching-rong Tai 1977 236 p
Avail: Univ. Microfilms Order No. 77-19482

A nonequimolar film model was developed based on the general multicomponent diffusion theory with the assumption that the multicomponent diffusion coefficients are independent of spatial position. The model provides a simple, convenient tool for the study of multicomponent gas diffusion under a wide range of boundary compositions. Ternary gas systems, each made up of oxygen and a counter-diffusing gas pair chosen among He, N2 and SF6 were studied theoretically to examine the oxygen flux in osmotic diffusion for different gas pairs. Comparisons were made between results obtained from the non-equimolar film model and those from the equimolar film model. The He-SF6 pair was found to have a maximum effect on the oxygen flux among the systems studied. The osmotic effect was more pronouned for equimolar condition than for the nonequimolar flux conditions. Dissert. Abstr.

N78-13156*# National Aeronautics and Space Administration, Washington, D. C.
KNOWLEDGE OF THE SYSTEMS H2O-SO3-N2O3. REPORT 1: THE SYSTEM H2SO4-H2O-N2O3
K. Stopperka and F. Kilz 12 Oct. 1977 17 p refs Transl. into ENGLISH from Z. Anorg. Allg. Chem. (East Germany), v. 348, 1966 p 58-70 Translated by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-2791)
(NASA-TM-75168) Avail: NTIS HC A02/MF A01 CSCL 07D

The amount of N2O3 being absorbed in 50-100% H2SO4 at 19, 60, and 95 C is directly proportional to the acid concentration and inversely proportional to the temperature. NO+ formation according to the above-formulated equation occurs only at H2SO4 concentrations greater than 52%. Absorption in highly concentrated sulfuric acid results in the formation of crystalline NOHSO4. Author

N78-13157*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FORMATION OF Na2SO4 AND K2SO4 IN FLAMES DOPED WITH SULFUR AND ALKALI CHLORIDES AND CARBONATES
George C. Fryburg, Robert A. Miller, Carl A. Stearns, and Fred J. Kohl 1977 19 p refs Presented at Symp. on High Temp. Metal Halide Chem., Atlanta, 9-14 Oct. 1977; sponsored by Electrochem. Soc.
(NASA-TM-73794) Avail: NTIS HC A02/MF A01 CSCL 21B

High pressure, free-jet expansion, mass spectrometric sampling was used to identify directly and to measure reaction products formed in doped methane-oxygen flames. Flames were doped with SO2 or CH3SH and sodium or potassium chlorides or carbonates. Gaseous NA2SO4 or K2SO4 molecules were formed in residence times on the order of msec for each combination of dopants used. Composition profiles of combustion products were measured and compared with equilibrium thermodynamic calculations of product composition. Author

N78-13158*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VOLATILE PRODUCTS FROM THE INTERACTION OF KCl(g) WITH Cr2O3 AND LaCrO3 IN OXIDIZING ENVIRONMENTS
Fred J. Kohl, Robert A. Miller, Carl A. Stearns, George C. Fryburg, and John G. Dillard 1977 15 p refs Presented at Symp. on High Temp. Metal Halide Chem., Atlanta, 9-14 Oct. 1977; sponsored by Electrochem. Soc.
(NASA-TM-73795) Avail: NTIS HC A02/MF A01 CSCL 07D

Cooled target collection techniques and high pressure mass spectrometric sampling were used to measure the relative rates of oxidative vaporization and to identify the volatile products emanating from samples of chromia and Mg-doped lanthanum chromite. The materials were exposed to partial pressures of KCl with and without H2O in one atmosphere of slowly flowing oxygen at elevated temperatures. Chromia and fresh samples of lanthanum chromite exhibited enhanced rates of oxidative vaporization upon exposure to these reactants. Mass spectrometric identification showed that the enhancements resulted from the heterogeneous formation of complex molecules of the type KCl sub 1,2,3 CrO3 and KOH sub 1,2 CrO3. Lanthanum chromite that had undergone prolonged oxidative vaporization exhibited no enhanced oxidation upon exposure to the reactants. Author

N78-13159*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTERACTION OF NaCl(g) AND HCl(g) WITH CONDENSED Na2SO4
Carl A. Stearns, Fred J. Kohl, George C. Fryburg, and Robert A. Miller 1977 21 p refs Presented at Symp. on High Temp. Metal Halide Chem., Atlanta, Ga., 9-14 Oct. 1977; sponsored by Electrochemical Soc.
(NASA-TM-73796) Avail: NTIS HC A02/MF A01 CSCL 07D

The interaction of Na2SO4(l) with NaCl(g), HCl(g) and H2O(g) was studied in atmospheric pressure flowing air and oxygen at Na2SO4(1) temperatures of 900 and 1000 C. Thermomicrogravimetric and high pressure mass spectrometric sampling techniques were used. Experimental results establish that previously reported enhanced rates of weight loss of Na2SO4(l) in the presence of NaCl(g) are due to the reaction: $Na_2SO_4(c) + 2HCl(g) = 2NaCl(g) + SO_2(g) + H_2O(g) + 1/2O_2(g)$ being driven to the right in flowing gas systems. The HCl(g) is the product of hydrolysis of NaCl caused by small but significant amounts of H2O(g) present in the system. Thermochemical calculations are used to show that even with sub-ppm levels of H2O(g) present, significant quantities of HCl(g) are produced. Author

N78-13160# Lockheed Missiles and Space Co., Palo Alto, Calif.
SPECTRAL-OPTICAL INVESTIGATION OF THE COMBUSTION MECHANISM OF A TITANIUM MIXTURE WITH CARBON
T. S. Azatian, V. M. Maltsev, A. G. Merzhanov, and V. A. Seleznev 1977 4 p refs Transl. into ENGLISH from Fiz. Goreniya Vzryva (USSR), v. 13, no. 2, 1977 p 186-188
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Cylindrical specimens of a titanium carbon mixture, having a density of 2.5 g/cm were burned in a constant pressure bomb in an inert argon atmosphere (p = 10 atm). A photographic method was used to determine the combustion velocity of the specimens which were also subjected to annealing in liquid argon, and burned in a vacuum so that the burnup process in the synthesis wave could be investigated. The combustion products were chemically analyzed for the free and bound carbon content. Adiabatic and maximal temperature values of the synthesis were computed and measured. The combustion velocity is shown to depend on the maximum temperature developed in the combustion front of the synthesis wave independently on the initial mixture composition (different values of the stoichiometric factor alpha, titanium disperseness, and also inert diluent content). A.R.H.

N78-13161# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE THEORY OF STATIONARY CONVECTIVE COMBUSTION
B. S. Ermolaev, B. A. Khasainov, A. A. Borisov, and A. I. Korotkov 1977 9 p refs Transl. into ENGLISH from Fiz. Goreniya Vzryva (USSR), v. 13, no. 2, 1977 p 169-175
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

In the case of one dimensional filtration model used in investigations of convective combustion in gas permeable powders and explosives, the velocity of the gas flow in the stationary mode is less than the stationary convective combustion velocity. Heat transfer from the combustion zone is possible only by a mechanism different from the leading filtration mechanism. The stationary convective combustion mode is shown to exist in a comparatively narrow pressure band and is characterized by a strong dependence of the propagation velocity on the pressure. This explains the easiness with which the convective combustion of explosive substances pressed into rugged shells go over to detonation. Dispersion to the side, which occurs in small diameter specimens placed in soft, rupturable shells narrows the choking domain and is a combustion stabilizing factor. A.R.H.

N78-13162# Texas Southern Univ., Houston. Dept. of Chemistry.
A STUDY OF NEW CATALYTIC AGENTS TO DETERMINE CHEMICAL OXYGEN DEMAND Progress Report, 20 Jul. 1976 - 20 Dec. 1977
Ray F. Wilson May 1977 39 p refs
(Grant EPA-R-803779-01)
(PB-270965/7; EPA-600/4-77-038) Avail: NTIS HC A03/MF A01 CSCL 13B

In order to reduce the cost of analysis, a catalyst was sought which could replace silver sulfate in the COD test. The results show that comparable results to the standard method for concentration of 50-500 mg/l could be obtained using a reduced amount of silver sulfate in combination with magnesium sulfate. Another procedure is described for determining COD in the range of 5-50 mg/l using a combination of silver sulfate, aluminum sulfate and magnesium sulfate to replace silver sulfate. GRA

N78-13163# Ames Lab., Iowa.
EVALUATION OF AN INDUCTIVELY COUPLED PLASMA, MULTICHANNEL SPECTROMETRIC ANALYSIS SYSTEM Interim Report, 1 Mar. 1973 - 31 Dec. 1975
R. K. Winge and J. M. Katzenberger Jun. 1977 57 p refs
(PB-270918/6; EPA-600/4-77-032) Avail: NTIS HC A04/MF A01 CSCL 14B

An inductively coupled plasma, multielement atomic emission spectrometric analysis system has been evaluated with respect to the need for a rapid method for determination of trace elemental concentrations in water. Data are presented on detection limits, curve fits and reproducibility of analytical curves, photomultiplier performance, dynamic range, reproducibility of analytical results, and stray light properties of the instrument. The instrument as a whole performed well, but stray light arising from calcium and magnesium in typical hard waters caused significant errors at low concentration levels for a number of critical elements. Suggestions for reduction of the stray light and for empirical correction of its effects are discussed. GRA

N78-13164# Illinois Univ., Urbana. Dept. of Chemistry.
DIOXETANONE CHEMILUMINESCENCE BY THE CHEMICALLY INITIATED ELECTRON EXCHANGE PATHWAY. THE EFFICIENT GENERATION OF EXCITED SINGLET STATES
Steven P. Schmidt and Gary B. Schuster 14 Oct. 1977 16 p refs
(Contract N00014-76-C-0745-07)
(AD-A045864) Avail: NTIS HC A02/MF A01 CSCL 07/3

The chemiluminescence of dimethyldioxetanone (1) in the presence of easily oxidized aromatic hydrocarbons was studied. It was observed that the rate of reaction of (1) depends upon the nature and concentration of the aromatic hydrocarbon. The efficiency of light production was correlated with the one electron oxidation potential of the hydrocarbon. These results are interpreted in terms of the recently described chemically initiated electron exchange luminescence. Author (GRA)

N78-13165# Illinois Univ., Urbana. Dept. of Chemistry.
DETECTION AND TRAPPING OF A CHEMILUMINESCENT ORTHO-XYLENE PEROXIDE. CHEMICAL LIGHT FORMATION ALONG TWO SEPARATE PATHS
Jimmie P. Smith and Gary B. Schuster 14 Oct. 1977 17 p refs
(Contract N00014-76-C-0745)
(AD-A045750) Avail: NTIS HC A02/MF A01 CSCL 07/4

Thermolysis of pyranone exdoperoxide (1) (prepared by singlet oxygenation of 1,4-diphenyl-2-benzopyran-3-one) in benzene solution leads to o-xylylene peroxide (2). Peroxide (2) is trapped in a Diels-Alder reaction with maleic anhydride to yield an adduct (6). It was observed that the chemiluminescence that resulted from the thermal reaction of peroxide (2) occurred by two distinct paths. The first occurred in the absence of easily oxidized aromatic hydrocarbons and was the result of the unimolecular rearrangement of (2) to electronically excited o-dibenzoylbenzene (4). In this case chemiluminescence was detected by energy transfer from excited (4) to suitable acceptors. The second occurred when any one of several easily oxidized aromatic hydrocarbons was included in the reaction solution. In this case light generation is apparently the result of chemically initiated electron exchange luminescence. GRA

N78-13166# Naval Weapons Support Center, Crane, Ind.
SPECIFIC HEATS OF AQUEOUS SOLUTIONS OF NaCl, NaBr, AND KCl. COMPARISONS WITH RELATED THERMAL PROPERTIES M.S. Thesis - Northwestern Univ. Final Report, 1 Mar. 1976 - 31 May 1977
J. E. Tanner, Jr. and F. W. Lamb 15 Jul. 1977 28 p refs Submitted for publication
(Contract E(11-1)-2882)
(AD-A045707; NWSC/CR/RDTR-58) Avail: NTIS HC A03/MF A01 CSCL 07/2

Precision measurements of specific heat capacities and heats of dilution have been the subject of many investigations in this laboratory; and many improvements in experimental methods were developed (see reference 1 for a summary) in an attempt to get sufficient accuracy so as to be able to verify the Debye-Huckel theory. In this paper, we present heat capacity results obtained by the authors on binary aqueous solutions of NaCl, KCl, and NaBr. The values for NaBr fill a gap in the literature. The values for the other two salts significantly extend the concentration-temperature ranges, and in some areas improve on the precision of the available values, or confirm precise values already in the literature. A theoretical interpretation of the results is not attempted. Author (GRA)

N78-13167# Princeton Univ., N. J. Dept. of Chemistry.
REACTIONS OF METAL-TO-METAL MULTIPLE BONDS. 3: ADDITION OF NITRIC OXIDE TO HEXAKIS (ALKOXY)-DIMOLYBDENUM COMPOUNDS. PREPARATION AND PROPERTIES OF BIS(NITROSYL)HEXAKIS(ALKOXY)

DIMOLYBDENUM COMPOUNDS AND STRUCTURAL CHARACTERIZATION OF THE ISOPROPROXY DERIVATIVE

M. H. Chisholm, F. A. Cotton, M. W. Extine, and R. L. Kelly 4 Oct. 1977 34 p refs Prepared in cooperation with Texas A and M Univ., College Station Submitted for publication
(Contract N00014-76-C-0826)
(AD-A045818; TR-77-03) Avail: NTIS HC A03/MF A01 CSCL 07/2

The occurrence of compounds containing metal-to-metal multiple bonds is now a well documented facet of transition metal chemistry. In this series we are studying the reactions of such compounds with regard to their ability (1) to undergo reactions of the type well documented in mononuclear chemistry and (2) to act as building blocks for the systematic synthesis of new cluster (polynuclear) compounds. Both have important catalytic implications. GRA

N78-13168# Stanford Research Inst., Menlo Park, Calif.
PHOTOOXIDATION AND ACCELERATED TESTING OF POLYPROPYLENE Final Report, 21 Jun. 1976 - 20 Jun. 1977

Frank R. Mayo and Thomas L. Nemzek 1977 71 p refs
(Contract DAAG29-76-C-0055)
(AD-A045600; ARO-13896.1-C) Avail: NTIS HC A04/MF A01 CSCL 11/9

The objectives of the research covered by this report were to consider several approaches to the testing problem and to study in more detail the approach found most promising. Several methods were examined for following reactions during the induction period. They have been grouped in this report into three major sections: Chemical Methods, Light Absorption and Emission Methods and Physical Changes. The most promising and practical approach to accelerated testing now appears to be the transducer-monitored pressure change. GRA

N78-13169# General Electric Co., Philadelphia, Pa. Re-entry and Environmental Systems Div.
CHEMICAL VAPOR DEPOSITION OF SILICON NITRIDE Summary Report, 1 Apr. 1976 - 31 Aug. 1977

R. A. Tanzilli, J. J. Gebhardt, and J. O. Hanson Sep. 1977 73 p refs
(Contract N00014-76-C-0547)
(AD-A045536; Doc-77SDR2257) Avail: NTIS HC A04/MF A01 CSCL 11/3

Experimental work during the past year has established the basic processing outlines for the deposition of crystalline alpha-Si3N4 plates and dome geometries. Preliminary correlations between critical processing variables and microstructure have been established. Property evaluations of deposits include: flexure strength, Young's moduli, thermal expansion, electromagnetic transmittance and reflectance, microhardness and fracture toughness deduced from identation and grooved double-cantilever beam experiments. Author (GRA)

N78-13170# Life Systems, Inc., Cleveland, Ohio.
DEVELOPMENT AND TESTING OF BREADBOARD ELECTROCHEMICAL ORGANIC CONTENT ANALYZER Annual Report, 30 Jun. 1976 - 1 Oct. 1977

R. J. Davenport and R. A. Wynveen Oct. 1977 73 p refs
(Contract DAMD17-75-C-5070)
(AD-A045557; LSI-ER-285-20) Avail: NTIS HC A04/MF A01 CSCL 13/2

A Breadboard Electrochemical Organic Content (EOC) Analyzer was designed and developed for on-line monitoring of organic solute concentrations in the ozonated effluent of the Water Processing Element Pilot Plant in the Medical Unit, Self- Contained, Transportable (MUST) hospital. Techniques were incorporated to eliminate various interferences. The test program included tests of the analyzer's response to organics and tests of the effectiveness of the interference eliminating components. The analyzer successfully completed 30 days of continuous, on-line operation without component failures. Results, conclusions and recommendations are presented. Author (GRA)

N78-13171# California Univ., Livermore. Lawrence Livermore Lab.
PROPAGATION OF A FLAME THROUGH A STRATIFIED CHARGE COMBUSTION CHAMBER

Charles K. Westbrook Jan. 1977 37 p refs Presented at 6th Intern. Colloq. on Gasdyn. of Explosions and Reactive Systems, Stockholm, Sweden, 22-26 Aug. 1977
(Contract W-7405-eng-48)
(UCRL-79094; Conf-770803-1) Avail: NTIS HC A03/MF A01

Flame propagation through stratified media is examined with a numerical model of chemically reactive flow in combustion systems. The model includes a detailed reaction mechanism for methane combustion and an implicit difference equation form for the hydrodynamics. Calculations of flames propagating through spatially uniform and stratified media are compared. It is found that hydrodynamic factors have a significant effect on the energy production rates, pressure rise rates, and unburned fuel concentrations for all models. For the stratified charge models it was found that CO and NO/sub x/production rates were significantly lower than for uniform charge models. Significant amounts of unburned fuel are found near the chamber wall, even in the stratified charge models so that reaction quenching at the wall will be important even in the stratified charge cases. Calculations are presented which predict improvements in fuel economy and decreases in pollutant formation, resulting from changes in fuel stratification and compression ratio. ERA

N78-13172# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
NONEQUILIBRIUM PHOTOCHEMICAL REACTIONS INDUCED BY LASERS Progress Report

J. I. Steinfeld Apr. 1977 26 p refs
(Contract EY-76-S-02-2793)
(MIT-2793-7) Avail: NTIS HC A03/MF A01

Infrared double resonance spectroscopy has been carried out on the nu3 reverse arrow 0 transmission in SF6. Both two-and three-level signals are observed. There is some indication of vibrational angular-momentum relaxation during the excitation pulse. Multiple infrared photon-induced dehydrohalogenation of vinyl chloride has been studied in detail. Excitation in either the nu7 or nu10 normal vibrations appears to be about equally effective in promoting the reaction. Multiple infrared photon excitation of B5H9 leads to production of B5H11 and B6H10 as well as molecular hydrogen and polymeric material. Intense chemiluminescence is also observed. ERA

N78-13173# Hanford Engineering Development Lab., Richland, Wash.
ANALYTICAL CHEMISTRY METHODS FOR HARDFACING MATERIALS

R. W. Stromatt, ed., W. L. Delvin, ed., J. E. Rein, ed., and W. H. Ashley, ed. Oct. 1974 86 p refs
(Contract EY-76-C-14-2170)
(HEDL-MG-18) Avail: NTIS HC A05/MF A01

Analytical chemistry methods are presented for the analysis of materials involved in coating metal surfaces with a hard, wear resistant surface called hardfacing. These materials are nichrome powder, chromium carbide, and the hardfacing, which is a mixture of nickel and chromium carbides. Hardfacing is applied to surfaces of stainless steel core components at points that are subject to excessive wear from frictional contacts. The objective, of course, is to prolong the life of those core components so treated. ERA

N78-13174# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
METHODS FOR CHEMICAL ANALYSIS OF THERMAL BATTERY COMPONENTS

C. P. Lofton, R. J. Antepenko, and W. W. Welbon 18 May 1977 22 p refs
(Contract EY-76-C-04-0656)
(GEPP-299) Avail: NTIS HC A02/MF A01

Analytical methods for the quantitative analysis of a number of components of thermal batteries have been developed and evaluated. This report describes these techniques used for quantitative analysis of the depolarizer-electrolyte-binder cathode, electrolyte and electrolyte binder material, calcium in the bimetal anode, and the pyrotechnic powder in the electrical match. These methods include classical chemical, ion specific electrode,

atomic absorption, X-ray emission and colorimetric procedures. Precision of each procedure is evaluated. ERA

N78-13175# Western Michigan Univ., Kalamazoo. Dept. of Chemistry.
FUNDAMENTALS OF NITRIC OXIDE FORMATION IN FOSSIL FUEL COMBUSTION Quarterly Progress Report, 11 Jun. - 10 Sep. 1976
T. Houser Nov. 1976 11 p refs
(Contract EX-76-C-01-2018)
(FE-2018-5) Avail: NTIS HC A02/MF A01

The reaction mechanism that leads to NO formation from fuel nitrogen was studied by determining the rates and mechanisms of pyridine pyrolysis and cyanogen oxidation. It was found that the rate of pyrolysis of C5D5N was about 60 percent of the pyrolysis rate of the normal pyridine. An isotope effect of this size is inconsistent with a nonchain reaction initiated by ring rupture. The oxidation of cyanogen appears to be first order and zero order with respect to cyanogen and oxygen respectively over a wide range of initial concentrations of these reactants. ERA

N78-13176# Stanford Research Inst., Menlo Park, Calif.
TEN NIOSH ANALYTICAL METHODS, SET-1
Mar. 1977 517 p refs
(Contract PHS-210-76-0123)
(PB-271712/2; NIOSH-SCP-FU-1) Avail: NTIS HC A14/MF A01 CSCL 07D

Industrial hygiene sampling and analytical methods were developed and validated under a follow-up research effort to develop measurement methods which failed to validate under the joint NIOSH/OSHA Standards Completion Program. This is the first set of 10 methods in an effort to develop methods for 130 substances. Monitoring methods for the following substances are included: Antimony and compounds, fluorotrichloromethane, dichloromonofluoromethane, dichlorotetrafluoroethane, carbon dioxide, cadmium fume, malathion, and vanadium V2O5 dust. GRA

N78-13177# Stanford Research Inst., Menlo Park, Calif.
TEN NIOSH ANALYTICAL METHODS, SET-2
Jul. 1977 316 p
(Contract DHEW-210-76-0123)
(PB-271464/0; NIOSH-SCP-FU-2) Avail: NTIS HC A14/MF A01 CSCL 07D

Industrial hygiene sampling and analytical methods were developed and validated. This is the second set of 10 methods in an effort to develop methods for 130 substances. Monitoring methods for the following substances are included: Allyl glycidyl ether, Benzoyl peroxide, Chlorodiphenyl(42% chlorine), Furfuryl alcohol, Hydroquinone, Iron oxide fume, Methylcyclohexanone, Methyl chloride, Stibine, and Vanadium (V2O5 fume). GRA

N78-13178# Environmental Research Lab., Athens, Ga.
RELIABLE ANALYSES OF WATER BY INDUCTIVELY COUPLED PLASMA EMISSION SPECTROSCOPY. ANALYTICAL CHEMISTRY BRANCH Interim Report
Charles E. Taylor Jun. 1977 43 p refs
(PB-271644/7; EPA-600/2-77-113) Avail: NTIS HC A03/MF A01 CSCL 07D

Reduction of stray light in the Inductively Coupled Plasma Emission Spectrometer (ICPES) has greatly increased its reliability as a technique for the multielemental analysis of water. Because of interferences introduced by matrix elements, reliable analysis of some less-sensitive elements has been impractical at concentrations of = or < 200 ppb. After surfaces in the secondary optical system were painted to prevent light scatter and the aperture at the primary lens was reduced in the ICPES, some interference corrections were reduced by more than one order of magnitude. Observed background changes caused by the presence of magnesium were obviated by adding matrix elements to calibration standards. Alcohol was added to standards, reagent blanks, and samples to overcome problems of background change during analysis of samples of unknown organic content such as municipal sewage. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N78-13179 British Library Lending Div., Boston Spa (England).
INTERNAL STRESSES IN ELECTROLYTICALLY DEPOSITED COPPER, NICKEL AND ZINC COATINGS
H. Orth May 1977 21 p refs Transl. into ENGLISH from Metalloberflaeche (West Germany), v. 30, no. 8, 1976 p 364-372
(BLL-RTS-10549) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL Overseas, 8 European or 30 WK BLL photocopy coupons

Macrostresses, internal stresses developing in metal during electrochemical deposition, were studied. Measurement and physical/chemical interpretation of these macrostresses were emphasized. Measurements were made with a spiral contractometer and with an adjusted 'rigid strip' instrument. Results indicate that grain boundaries affect internal stress. A probability ratio was derived for the stress-dislocation relationship revealing that dislocation is a cause of stress. B.L.P.

N78-13180 British Library Lending Div., Boston Spa (England).
PROBLEMS RELATING TO CORROSION IN ZINC ELECTRODES
K. Takahashi May 1977 46 p refs Transl. into ENGLISH from Boshogu Gijutsu (Japan), v. 23, no. 11, 1974 p 557-572
(BLL-RTS-10622) Avail: British Library Lending Div., Boston Spa, Engl.: £15.00; 14 BLL Overseas, 15 European or 60 UK BLL photocopy coupons

Corrosion and corrosion control in the Leclanche electrolyte and in alkaline electrolytes is discussed along with reactions of zinc with the electrolyte. The effect of Hg addition on passivation due to loading, the anornalous behavior of zinc in dissolution and precipitation in alkali solution, and elucidation of the conduction mechanism in a gelled powder disperse anode are among the topics considered. Suggestions for further research including measurement of the double layer capacvity of the Zn electrode surface are given. J.M.S.

N78-13181*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MECHANICAL PROPERTIES OF ION-BEAM-TEXTURED SURGICAL IMPLANT ALLOYS
A. J. Weigand 1977 24 p refs Presented at 24th Natl. Symp., Boston, 8-11 Nov. 1977; sponsored by Am. Vacuum Soc.
(NASA-TM-73742; E-9056-1) Avail: NTIS HC A02/MF A01 CSCL 11F

An electron-bombardment Hg ion thruster was used as an ion source to texture surfaces of materials used to make orthopedic and/or dental prostheses or implants. The materials textured include 316 stainless steel, titanium-6% aluminum, 4% vanadium, and cobalt-20% chromium, 15% tungsten. To determine the effect of ion texturing on the ultimate strength and yield strength, stainless steel and Co-Cr-W alloy samples were tensile tested to failure. Three types of samples of both materials were tested. One type was ion-textured (the process also heats each sample to 300 C), another type was simply heated to 300 C in an oven, and the third type was untreated. Stress-strain diagrams, 0.2% offset yield strength data, total elongation data, and area reduction data are presented. Fatigue specimens of ion textured and untextured 316 stainless steel and Ti-6% Al-4% V were tested. Included as an ion textured sample is a Ti-6% Al-4% V sample which was ion machined by means of Ni screen mask so as to produce an array of 140 mu m x 140 mu m x 60 mu m deep pits. Scanning electron microscopy was used to characterize the ion textured surfaces. Author

N78-13182*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ROOM TEMPERATURE CRACK GROWTH RATES AND -20 DEG F FRACTURE TOUGHNESS OF WELDED 1 1/4 INCH A-285 STEEL PLATE
John L. Shannon, Jr. and Walter Rzasnicki Nov. 1977 22 p refs

(NASA-TM-73847; E-9435) Avail: NTIS HC A02/MF A01 CSCL 11F

Data are presented which were developed in support of a structural assessment of NASA-LEWIS' 10-foot by 10-foot supersonic wind tunnel, critical portions of which are fabricated from rolled and welded 1 1/4 inch thick A-285 steel plate. Test material was flame cut from the tunnel wall and included longitudinal and circumferential weld joints. Parent metal, welds, and weld heat affected zone were tested. Tensile strength and fracture toughness were determined at -20 F, the estimated lowest tunnel operating temperature. Crack growth rates were measured at room temperature, where growth rates in service are expected to be highest. Author

N78-13183*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CYCLIC STRESS-STRAIN CURVE DETERMINATION FOR D6AC STEEL BY THREE METHODS

Alfred J. Nachtigall [1977] 6 p refs

(NASA-TM-73815; E-9402) Avail: NTIS HC A02/MF A01 CSCL 11F

The room temperature cyclic stress-strain was determined for D6AC low alloy steel by three different methods. The method that involves the use of a single specimen monotonic tension test after cyclic straining provided the best agreement with the accepted basic method which requires a number of companion specimen tests. The single specimen test is also the simplest to conduct. Author

N78-13184# Naval Postgraduate School, Monterey, Calif.

SCANNING ELECTRON MICROSCOPE STUDY OF POROUS ZINC BATTERY ELECTRODE OXIDATION AFTER SERVICE-LIKE EXPOSURES IN POTASSIUM HYDROXIDE ELECTROLYTE M.S. Thesis

John Robert Savory Jun. 1977 169 p refs

(AD-A045134) Avail: NTIS HC A08/MF A01 CSCL 10/3

Porous zinc battery electrodes were modeled for study of the oxidation products that are produced during discharge in an alkaline battery. Two- and three-dimensional pore models were used in the study. The electrodes were discharged galvanostatically in electrolyte solutions of potassium hydroxide. Oxidation product morphology was studied with a scanning electron microscope. Two types of oxidation product were observed. One type appeared to form directly on the electrode surface as the result of reaction between the zinc and the electrolyte. This product was dark colored and fairly complete on passivated surfaces. The other type of product was light colored and incomplete. It appeared as a second layer, usually found on top of the darker product. This second type of product appears to precipitate out of solution at passivation. Strong pitting of the zinc base metal accompanies the production of oxidation product. Author (GRA)

N78-13185# California State Dept. of Transportation, Sacramento. Transportation Lab.

CORROSION OF STEEL IN CONCRETE Final Report

D. L. Spellman and R. F. Stratfull Dec. 1976 45 p

(PB-270698/4; FHWA/CA-77-D-3-11) Avail: NTIS HC A03/MF A01 CSCL 13C

Findings presented in twelve individual interim reports are presented. Of the twelve, four are concerned with field investigations of corrosion-damaged bridges, two with the evaluation of bridge deck membranes, and six with the general subject of laboratory corrosion testing. The evaluation and study of corrosion-damaged bridges used chloride analysis of concrete samples, determination of metal loss of reinforcing steel samples, measurement of electrical potentials, the preparation of equipotential contour maps, and the determination of concrete delamination areas by sounding with chains. GRA

N78-13186# Vought Corp., Dallas, Tex.

STUDY TO IDENTIFY STRESS CORROSION PRONE PARTS ON THE TA-7C AIRCRAFT Final Report, Jun. 1976 - Jul. 1977

O. H. Cook Oct. 1977 158 p refs

(Contract N62269-76-C-0353)

(AD-A045489; Rept-2-53400/7R-3428) Avail: NTIS HC A08/MF A01 CSCL 11/6

This program was aimed at determining which parts in the TA-7C aircraft were prone to stress corrosion cracking, and then to establish corrective measures encompassing: (1) inspection criteria including NDI methods and intervals, (2) protection improvements, (3) material changes, and (4) design changes. The first task was the establishment of a stress corrosion cracking rating system based on evaluation parameters such as alloy/temper, product form, thickness, grain direction, protective systems, assembly and applied stresses and other influencing factors. This rating was tested for sensitivity relative to known failures. The ratings are presented in three forms: (1) Numeric, (2) Criticality, and (3) Stress Corrosion-Failure Probability. The second task was to survey select stress corrosion cracking prone parts for measurement of residual stresses in suspect locations. Measurements were made within the stress analyzer physical limitations, and these measured stress values correlated with calculated stress. The third task was to recommend inspection procedures and intervals, protective system changes, material/temper changes, and design changes. These are incorporated in the rating lists as a guideline to corrective action. Author (GRA)

N78-13187# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

TEMPERATURE CONDITIONS OF THE WORK OF MATRIX DURING HOT PRESSING STEELS WITH GLASS LUBRICANT

Yu. V. Manegin 16 May 1977 24 p refs Transl. into ENGLISH from Kuznechno-Shtampovochnoe Proizvodstvo (USSR), no. 11, 1972 p 10-13

(AD-A045437; FTD-ID(RS)T-0606-77) Avail: NTIS HC A02/MF A01 CSCL 11/6

The greatest heating of matrix/die is observed in the place of the transition of conical part to the calibrating mesh. The combination of high heating and large loads leads to the intensive wear of this zone of matrix/die. The basic heat shield of matrix/die from heating is reached as a result of applying a lubricating disk. Using this form of lubrication lowers the heating of matrix/die to 400 C and more. The value of the heating of matrix/die depends on the properties of the used lubricating disk, coefficient of drawing, velocity and method of pressure forging (with butt or without it). Author (GRA)

N78-13188# Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.

FRACTURE MECHANICS AND SURFACE CHEMISTRY STUDIES OF SUBCRITICAL CRACK GROWTH IN AISI 4340 STEEL

G. W. Simmons, P. S. Pao, and R. P. Wei Sep. 1977 53 p refs

(Contract N00014-75-C-0543; NR Proj. 036-097)

(AD-A045532; IFSM-77-33; TR-4) Avail: NTIS HC A04/MF A01 CSCL 11/6

Coordinated fracture mechanics and surface chemistry experiments were carried out to develop further understanding of environment enhanced subcritical crack growth in high strength steels. The kinetics of crack growth were determined for an AISI 4340 steel (tempered at 204 C) in hydrogen and in water, and the kinetics for the reactions of water with the same steel were also determined. A regime of rate limited (Stage II) crack growth was observed in each of the environments. Stage II crack growth was found to be thermally activated, with an apparent activation energy of 14.7+ or - 2.9 kJ/mol for crack growth in hydrogen, and 33.5+ or - 5.0 kJ/mol in water. Fractographic evidence indicated that the fracture path through the microstructure was the same for these environments, and suggested hydrogen to be the embrittling specie for environment enhanced crack growth in hydrogen and in water/water vapor. A slow step in the surface reaction of water vapor with steel was identified, and exhibited an activation energy of 36+ or - 14 kJ/mol. This reaction step was identified to be that for the nucleation and growth of oxide. The hydrogen responsible for embrittlement was presumed to be produced during this reaction. On the basis of a comparison of the activation energies, in conjunction with other supporting data, this slow step in the water/metal surface reaction was unambiguously identified as the rate controlling process for crack growth in water/water vapor. The inhibiting effect of oxygen and the influence of water vapor pressure on environment enhanced subcritical crack growth were considered.

The influence of segregation of alloying and residual impurity elements on crack growth was also considered. Author (GRA)

N78-13189# North Dakota State Univ., Fargo.
CHEMISTRY AND TECHNOLOGY OF METAL POWDERS Final Report, 1 Jun. 1974 - 14 Jun. 1977
Reuben D. Rieke Oct. 1977 10 p refs
(Grants DAHC04-74-G-0182; DAAG29-76-G-0234)
(AD-A045863; ARO-11431.3-C; ARO-14315.5-C) Avail: NTIS HC A02/MF A01 CSCL 11/6

A new process for the preparation of finely divided metal powders has been used in preliminary studies on a number of metal powders. The metals that were examined were found to exhibit far superior reactivity to that described in the literature for these metals or to that which found in the laboratories using the standard metals and techniques. The basic process involves the reduction of a metal salt in an ethereal or hydrocarbon solvent under an argon atmosphere. The reductions in some cases are very exothermic and generally are complete within a few hours. The reduction produces fine black powders of the metal in question. The properties of the black metal powders are, in many cases, highly dependent on the solvent used, the reducing agent, the anion of the metal salt being reduced, the ration of reducing agent such as potassium to the metal salt being reduced, and the temperature at which the reduction is being carried out. The bulk of the effort was devoted to a study to determine if highly reactive transition metal powders could be prepared via this reduction procedure. The metals which were studied were nickel, palladium, cobalt and platinum.
Author (GRA)

N78-13190# California Univ., Berkeley. Lawrence Berkeley Lab.
MECHANICAL PROPERTIES AND MICROSTRUCTURAL RELATIONSHIPS IN IRON-MANGANESE-CHROMIUM ALLOYS M.S. Thesis
L. D. Thompson Jan. 1977 158 p refs
(Contract W-7405-eng-48)
(LBL-6234) Avail: NTIS HC A08/MF A01

The relationships between microstructure and mechanical properties were studied for a series of Fe, Mn, Cr alloys. A combination of optical and scanning electron microscopy, EDAX analysis, and X-ray diffractometry was used to characterize the microstructures. Tensile testing and Charpy V-notch impact testing were utilized to study the mechanical properties. Triplex structures of gamma (fcc), alpha (bcc), and epsilon (hcp) were obtained in air-cool and quench-and-refrigeration heat treatments. Increasing volume fractions of metastable austenite and epsilon-martensite phases, which transform during testing, were found to have beneficial effects on the toughness and ductility properties, without significant losses in strength properties. A chromium concentration of 13 percent led to a better combination of strength and ductility than a concentration of 18 percent. ERA

N78-13191# Brookhaven National Lab., Upton, N. Y.
SOME CORRELATIONS OF HIGH-AND-LOW CYCLE FATIGUE DATA FOR 2 1/4 Cr-1 Mo STEEL IN THE ANNEALED, AND NORMALIZED AND TEMPERED CONDITIONS
P. Soo and J. G. Y. Chow Dec. 1976 29 p refs
(Contract EY-76-C-02-0016)
(BNL-NUREG-50610) Avail: NTIS HC A03/MF A01

High-cycle fatigue data for both annealed, and normalized and tempered 2 1/4 Cr-1 Mo steel were obtained from load-controlled tests at 1000 F and compared to strain-controlled low-cycle results from the literature. In the range of cycles where the two sets of data overlap, good correlations were obtained provided that the high-cycle stress values were converted to equivalent strains using appropriate cycle stress-strain curves. The fatigue strengths for both heat treatments were strongly dependent on the carbon level indicating that any carbon losses during fabrication or service are likely to detrimentally affect the fatigue resistance of reactor components. Specimen geometry is also shown to be an important consideration in the production of conservative fatigue data. Fatigue testing at ultrasonic frequencies yields much lower endurance limits when compared to normal high-cycle push-pull tests at 1000 F and this is possibly connected with localized deformation within the sample. ERA

N78-13192# California Univ., Berkeley. Lawrence Berkeley Lab.
USE OF MICROSTRUCTURE CONTROL TO TOUGHEN FERRITIC STEELS FOR CRYOGENIC USE. 2: FeMn steels
S. K. Hwang and J. W. Morris, Jr. Dec. 1976 24 p refs Presented at USSR-US Seminar on Appl. Problems of low-temperature Materials and the Manuf. of Welded Cryog. Struct., Kiev. (USSR), 12 Oct. 1976
(Contract W-7405-eng-48)
(LBL-5782; Conf-761085-1) Avail: NTIS HC A02/MF A01

The alloys Fe-12Mn-0.2Ti and Fe.8Mn-0.2Ti were specifically studied. In the as-quenched condition the alloys have ductile-brittle transition temperatures near -50 C and room temperature respectively. The brittleness of Fe-12 Mn is due to the intrusion of an intergranular fracture mode; that of Fe-8Mn is due to quasi-cleavage. The transition temperature of the 12Mn alloy may be suppressed by annealing in the two-phase (alpha + gamma) range to introduce a distribution of austenite or by grain refinement through deformation processing. In the latter case, an excellent combination of strength and toughness is obtained at liquid nitrogen temperature. The 12Mn alloy may not be thermally processed to fine grain size because of the malevolent influence of the epsilon-martensite phase present in the as-quenched structure. No such phase is present in the 8Mn alloy. This alloy may be thermally processed to ultrafine grain size with a concomitant marked improvement in low temperature mechanical properties. ERA

N78-13193# California Univ., Berkeley. Lawrence Berkeley Lab.
MECHANISM OF MARTENSITE TRANSFORMATION IN NEAR EQUIATOMIC NiTi ALLOY
H. A. Mohamed, M. O. Aboelfotoh, and J. Washburn Feb. 1977 25 p refs
(Contract W-7405-eng-48)
(LBL-5143) Avail: NTIS HC A02/MF A01

The martensitic-transformation in polycrystalline Ti-50.3 at pct. Ni alloy has been investigated using the technique of transmission-electron microscopy and diffraction. It was found that the extra reflections observed in the high temperature phase (CsCl, B2 type structure) are not related to the martensitic-transformation but are most likely associated with very fine ordered particles (less than 100A) of a Ni-rich phase, which is coherent with the CsCl-structure. The streaming or shimmering effects observed in bright-field images of a number of alloys which undergo martensitic-transformation and have sometimes been interpreted as a manifestation of lattice oscillations, were not observed in the present investigation. The martensitic-transformation may occur by [110] inhomogeneous shear of the CsCl-structure. ERA

N78-13194# Union Carbide Corp., Oak Ridge, Tenn. Nuclear Div.
REDUCED SINTERING DISTORTION IN TUNGSTEN, NICKEL, IRON ALLOYS BY USE OF ALLOYING ADDITIONS
W. G. Northcutt, Jr. 8 Mar. 1977 20 p
(Contract W-7405-eng-26)
(Y/DA-7117; USABRL-PRJ-NT12-7T) Avail: NTIS HC A02/MF A01

The slumping and distortion behavior of tungsten-nickel-iron (W-Ni-Fe) alloys containing 90 percent tungsten was studied. Additions of ruthenium, copper, cobalt, and hafnium either singly or in combination were made to a W-7 Ni-3 Fe alloy, and the sintering behavior of the alloys produced was observed as a function of sintering temperature and to some extent, the sintering time. Sintering temperatures were determined by differential thermal analysis, and sintered alloy microstructures were examined. Distortion of the W-7 Ni-3 alloy was reduced completely by ruthenium additions of 1 and 2 percent and was slightly reduced by copper, cobalt, and hafnium. ERA

N78-13195# Los Alamos Scientific Lab., N. Mex.
USE OF INTERMEDIATE HEAT TREATMENTS FOR THE RESTORATION OF THE NOTCH-RUPTURE PROPERTIES OF INCONEL 718
J. F. Muller and M. J. Donachie, Jr. 1977 18 p refs Presented at AIME Ann. Meeting, Las Vegas, Nev., 22 Feb. 1976

(Contract W-7405-eng-36)
(LA-UR-77-1090; Conf-760203-10) Avail: NTIS HC A02/MF A01

The effects of solution and intermediate heat treatments on the notch stress-rupture properties and microstructure of Inconel 718 were investigated. It was determined that a solution heat treatment of 1038 C for as short a time as 20 minutes could render the alloy notch sensitive by solutioning extensive quantities of the orthorhombic delta phase, Ni3Cb. Restoration of notch ductility was accomplished by the insertion of a 917 C (10 h) intermediate heat treatment, prior to aging, during which significant quantities of the delta phase were precipitated. This intermediate heat treatment was not successful in restoring notch ductility to specimens which had been given longer, one hour, solution heat treatments at 1038 C. Various other intermediate heat treatments were also investigated for their effects on notch-rupture properties. It was determined that the most important factors controlling the notch-rupture ductility in Inconel 718 are the size, quantity and distribution of the delta phase. The grain size of the material did not directly control the notch properties. ERA

N78-13196# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
THERMAL CONDUCTIVITY, ELECTRICAL RESISTIVITY AND SEEBECK COEFFICIENT OF HIGH PURITY IRON AND SELECTED IRON ALLOYS FROM 90 K TO 400 K M.S. Thesis
T. K. Holder Jun. 1977 110 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5539) Avail: NTIS HC A06/MF A01

The thermal conductivity, electrical resistivity, and Seebeck coefficient of high purity iron, two iron-chromium alloys, one iron-nickel alloy, and one iron-chromium-nickel alloy were measured over the temperature range from 90K to 400 K. Smoothed values for the thermal conductivity and electrical resistivity were used to calculate the electronic thermal conductivity, the lattice conductivity, and the Lorenz function by means of a binary alloy separation technique. The lattice conductivity and Lorenz function exhibited little change due to the addition of chromium; however, the addition of small amounts of nickel resulted in significant property changes. The lattice conductivity at high temperatures was calculated from theory and compared to experimental results. Good agreement between theory and experimental data was obtained. ERA

N78-13197# Sandia Labs., Albuquerque, N. Mex.
TENSILE YIELD AND FRACTURE BEHAVIOR OF BETA-3 TITANIUM
H. J. Rack 1977 29 p refs Presented at the 4th Intern. Conf. on Fracture, Waterloo, Canada, 19 Jun. 1977
(Contract EY-76-C-04-0789)
(SAND-76-5113; Conf-770601-4) Avail: NTIS HC A03/MF A01

The tensile yield and fracture behavior of Beta-3 titanium was investigated as a function of solution treatment condition and test temperature. Although varying solution treatment condition does not markedly affect the general tensile yield-temperature behavior of Beta-3, it does have a pronounced influence on the tensile ductility. Decreasing test temperature results in a ductile-ductile transition from a cup-cone ductile, dimple to a low energy shear fracture. Twinning was found to be the primary deformation mode at all temperatures and for all solution conditions. A fracture model is presented which is based upon the interrelationship between this deformation mode, the associated destruction of the athermal omega contained within this alloy and the fracture nucleation and propagation events. ERA

N78-13198# McElroy (Ralph) Co., Austin, Tex.
SELECTED PROBLEMS IN JOINING THIN ALUMINUM FOILS TO COPPER
Z. Nita 1974 13 p refs Transl. into ENGLISH from Schweisstechnik (Vienna), v. 24, no. 2, 1974 p 77-81
(BDX-613-1798) Avail: NTIS HC A02/MF A01

Experiments in the joining of thin Al to Cu by resistance welding are described, along with experiments using direct pressure welding. Tests of the corrosion resistance of the welds, dynamic tests, and mechanical properties are discussed. ERA

N78-13199# Liquid Metal Engineering Center, Canoga Park, Calif.
EFFECT OF HEATING RATE ON CAUSTIC STRESS CORROSION CRACKING
M. E. Indig (GE, Pleasanton, Calif.) and N. J. Hoffman 1977 20 p Presented at the Corrosion/77 NACE Meeting, San Francisco, Calif., 14-18 Mar. 1977
(Contract EY-76-C-03-0700)
(CONF-770303-10; Paper-135) Avail: NTIS HC A02/MF A01

To evaluate effects of a large water leak into the sodium side of a steam generator in a liquid metal fast breeder reactor, a series of tests were performed. This test series involves heating a large steam generator that possibly contains localized pockets of aqueous caustic retained from a previous sodium-water reaction. Such pockets of caustic solution could be in contact with welds and other components that contain residual stresses up to the yield point. The effect of heating rate on caustic stress corrosion cracking (SCC) for alloys either used or considered for the test rig was studied. A summary of the temperatures and caustic concentration ranges that can result in caustic SCC for carbon steel and Type-304 stainless steel is given. ERA

N78-13200# General Electric Co., San Jose, Calif. Boiling Water Reactor Systems Dept.
DETECTION OF SENSITIZATION IN STAINLESS STEEL USING ELECTROCHEMICAL TECHNIQUES
W. L. Clarke, V. M. Romero, and J. C. Danko Aug. 1976 84 p refs
(Contract E(04-3)-189)
(GEAP-21382) Avail: NTIS HC A05/MF A01

The feasibility of measuring the degree of sensitization (DOS) in thermally treated type-304 stainless steel by using an electrochemical technique was determined. A data base is being developed for evaluating sensitization and subsequent intergranular stess corrosion cracking (IGSCC) susceptibility of welded components in the field. The technique is considered viable and superior to the presently used chemical method for laboratory evaluation of welded and as-received conditions. The data developed indicate good correlation between DOS, as measured electrochemically, and IGSCC resistance of mill-annealed, furnace sensitized, and as-welded material. ERA

N78-13201# Mound Lab., Miamisburg, Ohio.
SUMMARY REPORT OF THE COMPRESSIVE CREEP PROPERTIES OF IRRADIATED AND UNIRRADIATED MOLYBDENUM
Ronald E. Zielinski 15 Apr. 1977 88 p refs
(Contract EY-76-C-04-0053)
(MLM-2406) Avail: NTIS HC A05/MF A01

Compressive creep tests were performed on molybdenum samples exposed to four different pretest conditions: (1) annealed; (2) annealed and neutron irradiated at 480 C to a fluence of 5 x 10 to the 19th power n; (3) stress relieved; and (4) stress relieved and neutron irradiated at reactor ambient temperature to a fluence of 1 x 10 to the 19th power n sq cm. The tests were performed in the temperature range of 600 to 900 C with an initial applied stress of 176.5 MPa. Both pre- and post-test specimens were examined using electron microscopy and the relationship between substructure and mechanical properties is discussed. Possible controlling mechanisms of deformation are proposed and activation energies for creep are determined. ERA

N78-13202# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
CORROSION OF SEVERAL METALS IN SUPERCRITICAL STEAM AT 538 DEG C
H. E. McCoy and B. McNabb May 1977 47 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5781) Avail: NTIS HC A03/MF A01

The corrosion of several iron-and nickel-base alloys in supercritical steam at 24.1 MPa (3500 psi) and 538 C was measured to 7.92 x 10 to the 7th power (22,000 h). Corrosion was measured almost entirely by weight change and visual appearance; a few samples were evaluated by more descriptive analytical techniques. The corrosion rates of low-alloy ferritic

steels containing from 1.1 to 8.7 percent Cr and 0.5 to 1.0 percent Mo differed by less than a factor of 2 in steam. Several modified compositions of Hastelloy N were evaluated and found to corrode at about equivalent rates. Of the alloys studied, the lowest weight gain 3.6 x 10 to the 7th power sec (10,000 hr) was 0.01 mg/sq. cm. for Inconel 718 and the highest 10 mg/sq.cm. for the low-alloy ferritic steels. ERA

N78-13203# Sandia Labs., Albuquerque, N. Mex.
DUCTILITY IN HOT ISOSTATICALLY PRESSED 250-GRADE MARAGING STEEL
R. M. German and J. E. Smugeresky Mar. 1977 38 p refs Presented at the AIME Fall Meeting, Niagara Falls, N. Y., 20 Sep. 1976 Sponsored by ERDA
(SAND-76-8516; Conf-7609106-6) Avail: NTIS HC A03/MF A01

Prealloyed 250-grade maraging steel powder produced by the rotating electrode process was fully consolidated by hot isostatic pressing (HIP) at 1100 and 1200 C. The strength following aging equalled that of wrought material; however, ductility was negligible. This lack of ductility in the powder metallurgy product was traced to titanium segregation which occurred at the powder surface during powder production. The formation of a titanium intermetallic at the prior particle boundaries during aging caused failure at low plastic strains. Altered aging treatments successfully broke up the embrittling film and resulted in a significant ductility recovery for the HIP material. Analysis of the fracture process indicates that further ductility gains are possible by reducing the titanium content, refining the particle size, and optimizing the thermal cycles. ERA

N78-13204# European Space Agency, Paris (France).
HYDROGEN ABSORPTION OF FRESHLY-GENERATED TITANIUM SURFACES
Hans-Joachim Raetzer-Scheibe, Ulf Spriestersbach, Horst Buhl, and Markus Stoeppler Oct. 1977 26 p refs Transl. into ENGLISH of 'Wasserstoff-Absorption von aktiven Titan-Grenzflaechen', DFVLR, Cologne Report DLR-FB-77-14, 6 Apr. 1977 Original report in GERMAN previously announced as N77-32306 Original German report available from DFVLR, Cologne DM 12.40
(ESA-TT-423; DLR-FB-77-14) Avail: NTIS HC A03/MF A01

The absorption of tritium on active titanium interfaces in aqueous NaCl solution under potentiostatic conditions can give data concerning the hydrogen absorption of the titanium alloys Ti6Al4V. The known potential dependence of the SCC (stress corrosion cracking) susceptibility of this alloy in such electrolytes should yield information concerning the significance of hydrogen in the SCC mechanism. Results show that the potential has no effect on the tritium content in the range +1600 to -1400 mV (Ag/AgCl). Since the SCC susceptibility of this material is highly potential-dependent in this range, it can therefore be concluded that the effect of the hydrogen is not as significant as was previously assumed. Author (ESA)

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N78-13205 Vanderbilt Univ., Nashville, Tenn.
ELECTRICAL PROPERTIES OF DEVITRIFIED GLASSES AND CRYSTALLIZATION CHARACTERISTICS IN THE TERNARY SYSTEM Na2O-Nb2O5-P2O5 Ph.D. Thesis
John Hassan Dayani 1976 123 p
Avail: Univ. Microfilms Order No. 77-16061

Glasses were prepared in the ternary system Na2O-Nb2O5-P2O5. A portion of the region of the ternary diagram from which useful glass ceramics can be made was identified. Nucleating agents were added to promote, by heat treatment, crystallization of $NaNbO_3$ from the amorphous glass samples. X-ray diffraction examination of the resulting glass ceramics showed that it was possible to obtain only $NaNbO_3$ crystals in the devitrified samples. Optical microscopy revealed the phase separated structure which accompanies and precludes the crystallization. Bulk dielectric measurements of well crystallized samples showed that the dielectric properties at 1000 Hertz closely correspond to those of single crystalline $NaNbO_3$. High dielectric constants were obtained near the transition temperatures 250 C - 316 C, varying with degree of crystallization. Dielectric loss measurements taken away from the transition temperature showed that the amount of dielectric loss angle was proportional to the volume fraction of the glassy phase present. Dissert. Abstr.

N78-13206 California Univ., Berkeley.
CRACK GROWTH IN GLASS SUBJECTED TO CONTROLLED IMPACTS Ph.D. Thesis
William Edward Snowden 1976 285 p
Avail: Univ. Microfilms Order No. 77-15863

Crack growth in borosilicate glass plates subjected to controlled impacts was studied using high speed streak photography. Target plates containing thermally-induced precracks were impacted using a magnetic hammer system capable of providing impacts at known velocities and times. The maximum stress in the targets following impact increased approximately linearly with the velocity of the aluminum flyers. The duration of the stress waves generated on impact varied with the flyer thickness. The relation between stress pulse characteristics and crack growth was examined in an attempt to establish a criterion for fracture by stress waves. Critical impact velocities required for crack growth were determined for a range of experimental conditions. Corresponding stress histories at the crack front position in the target plates were calculated using finite difference computer codes. Dissert. Abstr.

N78-13207 Arizona Univ., Tucson.
ELECTRICAL AND ELECTROCHEMICAL INVESTIGATIONS OF POLYMER MEMBRANE ION-SELECTIVE ELECTRODES Ph.D Thesis
Gary David Carmack 1977 152 p
Avail: Univ. Microfilms Order No. 77-18572

The observation that solutions of ion-association complexes dissolved in a polymeric matrix exhibited a very high temperature coefficient of resistance led to the systematic study of the experimental parameters that play important roles in this semiconductor-like behavior. Electrothermal analyses showed that the electrical conductivity of these polymer mixtures are reminiscent of that observed with organic semiconductor materials in which electrons are the charge carriers. However, the polymer films had higher conductivity than organic semiconductors of comparable activation energy of conduction values. Furthermore, studies of the electrical conductivity measured as a function of time, voltage, and dielectric constant indicated that the conduction mechanism was ionic. Dissert. Abstr.

N78-13208 Wisconsin Univ., Madison.
BOUNDARY LAYERS IN THERMOSET ADHESIVES Ph.D. Thesis
James Leo Racich 1977 289 p
Avail: Univ. Microfilms Order No. 77-14356

Transmission electron microscopic examination of epoxy resins and one stage resole phenolic and urea modified phenolic resins yielded evidence of distinct nodular microstructure, 75 A to 1000 A in diameter. Data were taken from platinum-shadowed carbon replicas of free, low temperature fractured, solvent and acid etched, and interfacial contacted resins. Substrate interfacial contact was shown to influence the size and packing of modules. For tertiary amine and polyamine cured DGEBA resins, an increase in amine concentration resulted in smaller modules. Many interfacial contact specimens showed a two boundary layer, or three layer interface, with the size of the modules in the layer nearest the interface smaller than in the succeedingly distant layer. Dissert. Abstr.

N78-13209*# General Electric Co., Philadelphia, Pa.
IMPROVED CERAMIC HEAT EXCHANGER MATERIAL Interim Report
H. W. Rauch Nov. 1977 35 p ref
(Contracts NAS3-19698; EC-77-A-31-1011)
(NASA-CR-135292; CONS/9698-1) Avail: NTIS HC A03/MF A01 CSCL 11G

Various ceramic materials in the form of small, monolithic bars were screened as candidate materials in heat exchanger

structures for automotive gas turbine engines. Small bar-shaped specimens of the honeycomb were used to measure thermal, chemical, and mechanical properties and for macro- and microstructure examinations. Cylindrical honeycomb specimens about 15.2 cm diameter and 10.2 in. thick are currently being tested in a gas turbine engine. Data obtained from testing the bar-shaped honeycomb specimens of GE-3200 and from testing bar-shaped honeycomb specimens of Corning 9455 were compared. Results indicate that GE-3200 has significantly better resistance to sulfuric acid and to sodium chloride than Corning 9455; thermal expansion of GE-3200 is higher than that of Corning 9455; mechanical properties of GE-3200 are higher in the tangential direction, but lower in the radial direction than Corning 9455; and during thermal cycling between R.T. 1000 C and R.T - 1100 C, GE-3200 tends to elongate while Corning 9455 tends to slightly contract. Overall assessment of GE-3200 properties, ease of material preparation, ready adaptability to honeycomb fabrication, and refractoriness qualify this new material as a candidate for heat exchanger application in automotive gas turbine engines. Author

N78-13210# Pennsylvania Univ., Philadelphia. Dept. of Metallurgy and Materials Science.

ENVIRONMENTAL EFFECTS ON THE DEFORMATION OF POLYMERS AT LOW TEMPERATURE Final Report, 1 Mar. 1974 - 28 Feb. 1977

Norman Brown 15 Jun. 1977 38 p refs

(Grant DAHC04-74-G-0121; DAAG29-76-G-0175)

(AD-A045726; ARO-11782.13-MS; FR-1) Avail: NTIS HC A03/MF A01 CSCL 11/9

The mechanical properties of every linear polymer are affected by liquid and gaseous nitrogen, argon, and oxygen if the temperature is less than about 70 degrees above the boiling point. The tensile strength decreases and the creep rate increases with respect to an increase in the surface concentration of the gas. The surface concentration is related to the pressure and temperature by the parameter peQ/RT where Q was about equal to the heat of vaporization of the gas. The usual effect of the gas was to produce crazes. About 12 gases were tested and the only two gases that had no effect were helium and hydrogen because they have low heats of vaporization. The range of the experiments were from 78K to the glass transition temperature. The mechanical behavior was also found to depend on the size and shape of the specimen as measured by area per unit volume because crazes usually nucleate at the surface. It was found that the macroscopic mechanical behavior could be quantitatively derived from the measurable microscopic parameters of the crazes. The pressure range of 0-1 atmospheres was investigated. Author (GRA)

N78-13211# Montana Energy and MHB Research and Development Inst., Inc., Butte.

THERMAL CONDUCTIVITY AND DIFFUSIVITY OF ENGINEERING CERAMICS Final Technical Report, Jul. 1976 - Jun. 1977

D. P. H. Hasselman and G. E. Youngblood 30 Jun. 1977 124 p refs

(Contract N00014-76-C-0884)

(AD-A045527) Avail: NTIS HC A06/MF A01 CSCL 11/2

This report summarizes the results of a one-year extension of a research program devoted to an investigation of the effect of compositional and microstructural variables on the thermal conductivity/diffusivity and thermal stress resistance of engineering ceramics. A total of six completed studies have resulted during this extension, with a seventh in preparation, as follows: (1) Thermal Diffusivity of Microcracked Ceramic Materials. (2) Thermal Diffusivity and Thermal Conductivity of a Fibrous Alumina. (3) Thermal Diffusivity/Conductivity of Alumina with a Zirconia Dispersed Phase. (4) Effect of Crystallization on the Thermal Diffusivity of a Mica Glass-Ceramic. (5) Effect of Microcracking on the Thermal Diffusivity of Polycrystalline Aluminum Niobate. (6) Enhanced Thermal Stress Resistance of Structural Ceramics with Thermal Conductivity Gradient. (7) Effect of Crystallization on the Thermal Diffusivity of a Cordierite Glass-Ceramic. Author (GRA)

N78-13212# National Bureau of Standards, Washington, D. C. Recycled Oil Program.

MEASUREMENTS AND STANDARDS FOR RECYCLED OIL Final Report

D. A. Becker Aug. 1977 145 p Presented at a workshop, National Bureau of Standards in Gaithersburg, Md., 22-23 Nov. 1976

(PB-271562/1; NBS-SP-488; LCCN-77-600032) Avail: NTIS HC A07/MF A01 CSCL 11H

The following papers are presented: the NBS workshop objectives and the NBS recycled oil program; burning used oil at a military installation; fuel oil and the Defense Supply Agency; fuel oil specifications; automotive crankcase drainings used for fuel; ASTM test methods for industrial oils; industrial oil recycling at Chrysler; industrial oils-descriptions, additives, and test methods; the use of recycled industrial and hydraulic oils at Ford; industrial lubricants, reclaimed oils, and test methods; DOD experiences in testing tube oils; waste oil recycling--an idea whose time has come; comments on additive response to different base oils; and activities of the ASTM used oil task force. GRA

N78-13213# Lehigh Univ., Bethlehem, Pa.

CRACK PROPAGATION IN STRUCTURAL CERAMICS SUBJECTED TO THERMAL STRESS Final Report, 15 Nov. 1975 - 31 Aug. 1977

E. P. Chen and D. P. H. Hasselman Aug. 1977 5 p refs

(Contract DAAG29-76-G-0091)

(AD-A045794; ARO-13168.10-MS) Avail: NTIS HC A02/MF A01 CSCL 11/2

This program was devoted to the thermal fatigue behavior and failure prediction of structural ceramics under thermal stress. The materials investigated include soda-lime-silica glass, silicon nitride, silicon carbide and alumina. Another phase of the program dealt with the self-fatigue in surface compression strengthened glass plates. That the strength of glass plates can be improved by introducing residual stresses into the material is well known. However, brittle glass strengthened in this manner appears to be susceptible to spontaneous fragmentation even during the complete absence of applied loads. The problem was analyzed from the fracture mechanics point of view. Author (GRA)

N78-13214# Bendix Corp., Kansas City, Mo.

MATERIAL AND PROCESSING COMPARISONS OF FOUR CONFORMAL COATINGS Final Report

D. J. Caruthers Mar. 1977 54 p refs

(Contract EY-76-C-04-0613)

(BDX-613-1496-Rev) Avail: NTIS HC A04/MF A01

The processing and properties of four materials in common use as conformal coatings were evaluated and compared. The processes were optimized to obtain the highest level of electrical properties, and direct comparisons of physical properties at three temperatures are included. ERA

N78-13215# Brookhaven National Lab., Upton, N. Y.

CONCRETE POLYMERS: PAST, PRESENT, AND FUTURE

M. Steinberg 1977 18 p refs Presented at Intern. Symp. on New Horizons in Construction Mater., Bethlehem, Penn.

(Contract EY-76-C-02-0016)

(BNL-22524; Conf-761228-1) Avail: NTIS HC A02/MF A01

The principal characteristics of concrete polymer materials are reviewed and relative advantages are compared. PC and PIC materials have been developed for uses including highway and bridge deck applications, water dam repairs, Japanese developments, housing and railroad stations, geothermal applications, municipal solid waste utilization and solidification of radioactive waste. The various concrete-polymer materials are beginning to take their place as very versatile and economical construction materials. ERA

N78-13216# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.

PROCESSING A DIFFICULT URETHANE ELASTOMER SYSTEM

T. J. Gillespie 13 May 1977 16 p

(Contract EY-76-C-04-0656)

(GEPP-304) Avail: NTIS HC A02/MF A01

An adiprene/butanediol/trimethylolpropane elastomer system and the associated production process were studied. Sufficient control of the manual process could not be obtained to eliminate significant physical property variability. A tracer agent was

introduced into the curing agent system to assess the distribution of the curing agent in the elastomer. Machine evaluation using the tracer agent indicated that distribution of the curing agent in the elastomer was very poor inspite of the high shear mixing configuration. The addition of an oscillating motion to the mixing system significantly improved curing agent distribution and eliminated material property variability problems. ERA

N78-13217# Purdue Univ., Lafayette, Ind.
EFFECTS OF INTERNAL GAS PRESSURE AND MICROSTRUCTURE ON THE MECHANISMS OF HOT-PRESSING AND SWELLING IN CERAMICS Progress Report, 1 Jun. 1976 - 31 Mar. 1977
A. A. Solomon Feb. 1977 34 p refs
(Contract EY-76-S-02-2713)
(COO-2713-3) Avail: NTIS HC A03/MF A01

The low temperature isostatic pressurization system was completed, operated successfully and calibrated. The new high temperature TD tungsten vessel and MoSi2 element furnace system was also designed. Porous CoO single crystals were grown using a skull melting process. Automated quantitative microscopy techniques are being developed to examine porosity evaluation during hot pressing and sintering. Initial sintering experiments under variable isostatic pressures from 100 micrometers Hg to 2000 psi reveal no significant effect of ambient pressure; nor were differences observed in sintering kinetics when either helium or argon were used as the pressurizing gas. Swelling experiments, conducted by reducing the ambient pressure after pore closure, revealed dramatic changes in density. ERA

N78-13218# California Univ., Livermore. Lawrence Livermore Lab.
ANALYSIS ON THE PREPARATION OF ALUMINUM ANTIMONIDE AS AN ELECTRONIC DEVICE MATERIAL
J. W. Sherohman 8 Feb. 1977 14 p refs
(Contract W-7405-eng-48)
(UCRL-52224) Avail: NTIS HC A02/MF A01

An analysis of the technical problems of the Al-Sb system and the progress of a research program to resolve these difficulties are discussed. In terms of experimental achievement, the use of Al2O3 crucibles along with the original method of adding Sb by a molybdenum mesh basket has, for the first time, permitted growth of AlSb from a melt free of oxide. A discussion is presented on research objectives and recommended areas for further study. ERA

N78-13219# Lockheed Missiles and Space Co., Palo Alto, Calif.
CREEP OF A POLYFLUOROETHYLENE RESIN UNDER THE COMBINED EFFECT OF TENSION AND HYDROSTATIC PRESSURE
O. E. Olkhovik and A. Ia Goldman 1977 7 p refs Transl. into ENGLISH from Mekh. Polim., (USSR), no. 3, 1977 p 434-438
Avail: NTIS HC A02/MF A01

Creep test results for polytetrafluoroethylene under tension with high hydrostatic pressure are presented, along with tests under volume compression conditions in a broad range of temperatures and pressures. An attempt was made to verify known methods of predicting deformability by introducing a reduction factor taking into account the influence of pressure. Author

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N78-13220 Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
JANNAF STRUCTURES AND MECHANICAL BEHAVIOR WORKING GROUP, VOLUME 1
Ronald D. Brown Apr. 1977 157 p Presented at 14th meeting, 15-17 Feb. 1977
(Contract N00017-72-C-4401)
(CPIA-Pub-283-Vol-1) Avail: Issuing Activity

Methods for the prediction of structural integrity of chemical propulsion system under operational and environmental loading conditions are examined. Some of the following topics are discussed in detail; (1) The Duomorph; A complex modulus transducer; (2) Storage of solid propellants in space; (2) Two devices for high speed tensile testing; and (4) Permanent set in solid propellants. For individual titles, see N78-13221 through N78-13232.

N78-13221# Texas A&M Univ., College Station. Dept. Civil Engineering.
THE DUOMORPH: A COMPLEX MODULUS TRANSDUCER
Ron Boggess and James Noel *In* APL JANNAF Struct. and Mech. Behavior Working Group, Vol. 1 Apr. 1977 p 1-11 refs (For availability see N78-13220 04-28)
Avail: Issuing Activity

A data reduction procedure based on the difference of the duomorph response in air to the response in a material and a simple graph based on circular plate bending theory is described. The amount of bending is a function of the stiffness of the duomorph element, excitation, and the modulus of the material being tested. Characterization using the method was verified by two separate techniques. Dynamic duomorph data were compared to resilient modulus data taken with the Schmidt Mark 3 Resilient Modulus Device. Data also were compared to creep tests run with a cylindrical indentor. Properties, using the device, were determined for solid rocket propellants, asphaltic concretes, fine grained solids and rubbers. Author

N78-13222*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STORAGE OF SOLID PROPELLANTS IN SPACE
D. E. Udlock *In* APL JANNAF Struct. and Mech. Behavior Working Group, Vol. 1 Apr. 1977 p 13-22 refs (For availability see N78-13220 04-28)
Avail: Issuing Activity CSCL 21I

A test program is described which determines the extent of physical property changes that result from extended space exposure. Primary emphasis was placed on determining the effects of space vacuum. Solid propellants were stored and their physical properties tested in a vacuum and in a dry environment. The storage caused significantly greater increases in the propellants' modulus and maximum tensile strength than occurred in parallel ambient stored samples. The data indicate that the loss of trace amounts of residual moisture from cured propellant is the apparent cause of the observed propellant property changes. Therefore, initial screening tests were carried out under dry storage conditions. Upon completion of the dry storage tests, appropriate propellant samples are exposed to an actual space environment using the Long Duration Exposure Facility (LDEF). Author

N78-13223# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
MODIFICATION OF AEROJET CUMULATIVE DAMAGE CRITERION TO UTILIZE NONLINEAR STRESS ALLOWABLE
R. V. Mellette *In* APL JANNAF Struct. and Mech. Behavior Working Group, Vol. 1 Apr. 1977 p 23-40 refs (For availability see N78-13220 04-28)
Avail: Issuing Activity

The use of an endurance stress causes the allowable stress curve for Bills' Aerojet failure criterion to be nonlinear in the log-log plane. A method of determining the nonlinear allowable curve based on the stress relaxation equilibrium time and on a minimum endurance stress was developed. Numerical integration methods for utilizing the nonlinear allowable curve for a linear variation of load induced stress were determined. These methods were evaluated by using them to perform a parametric analysis for Castor 2 motor 120 day hang. Recommended methods for utilization of the nonlinear stress allowable were determined. Numerical results indicate an appreciable difference from those obtained using a linear allowable, however, results are consistent with actual Castor 2 motor 120 day hang test results. Author

N78-13224# Naval Weapons Center, China Lake, Calif.
TWO DEVICES FOR HIGH SPEED TENSILE TESTING
A. H. Lepie *In* APL JANNAF Struct. and Mech. Behavior Working Group, Vol. 1 Apr. 1977 p 41-50 refs (For availability see N78-13220 04-28)
Avail: Issuing Activity

Two devices for uniaxial tensile testing of propellants and polymeric binders at medium to high straining rates are described. The first device is capable of constant rates from 10 to 3500 cm/min. It uses a pulley piano wire arrangement which is controlled by a magnetic clutch. The second device is a modified Charpy-Izod impact pendulum and allows straining rates from 3000 to 20,000 cm/min. The stress time curve and displacement time curve are recorded on an oscilloscope. The stress-strain properties of a composite CTPB propellant from 0.02 to 20,000 cm/min were examined. Author

N78-13225# Naval Weapons Center, China Lake, Calif.
ADVANCED PHYSICAL CHARACTERIZATION OF SOLID PROPELLANTS. PART 1. DAMAGE, VOLUME CHANGE AND DYNAMIC PROPERTIES UNDER STRAIN
A. H. Lepie and A. Adicoff *In* APL JANNAF Struct. and Mech. Behavior Working Group, Vol. 1 Apr. 1977 p 51-61 refs (For availability see N78-13220 04-28)
Avail: Issuing Activity

The damage behavior including dewetting was studied on five experimental composite propellants. Straining experiments at low rates with superimposed tension cycles and simultaneous volume dilatation measurements revealed that a critical stess-strain condition exists where volume dilatation and dewetting begins. The initiation of dewetting is associated with the maximum of the dynamic modulus versus strain curve. The strain-induced damage effects of the five propellants are compared graphically. Author

N78-13226# Thiokol Chemical Corp., Brigham City, Utah. Thiokol/Wasatch Div.
PERMANENT SET IN SOLID PROPELLANTS
G. P. Anderson, S. J. Bennett, and L. E. Jensen *In* APL JANNAF Struct. and Mech. Behavior Working Group, Vol. 1 Apr. 1977 p 63-68 (For availability see N78-13220 04-28)
Avail: Issuing Activity

Testing of an 88% solids CTPB propellant stored under load (constant strain) for various time-temperature combinations demonstrated that the propellant retained a memory of the deformed state. Even if temporarily forced to its original undeformed geometry, a return to a geometry intermediate between the initial and loaded geometries was observed when the load was removed. The terminology 'permanent set' is used to describe the phenomenon. Permanent set was defined as the difference in a linear geometric dimension before and after conditioning divided by the dimensional change induced by the applied displacement. Author

N78-13227# Aerojet Solid Propulsion Co., Sacramento, Calif.
TIME-TEMPERATURE SUPERPOSITION DOES NOT HOLD FOR SOLID PROPELLANT STRESS RELAXATION
K. W. Bills, Jr. and K. H. Bischel (Naval Weapons Center, China Lake, Calif.) *In* APL JANNAF Struct. and Mech. Behavior Working Group, Vol. 1 Apr. 1977 p 69-85 refs (For availability see N78-13220 04-28)
Avail: Issuing Activity

Solid propellants were shown to be thermortheologically complex from two points of view; (1) time-temperature superposition, and (2) strain level dependence of the modulus. The impact of these observations was underscored by a number of experiments which suggest that conventional stress analyses may be in error by as much as 200 to 600%. Composite propellants were shown to become discontinuous materials under strain. No examples were given to show the importance of localized strain discontinuities to grain structures. Author

N78-13228# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
REDUCED VARIABLE TECHNIQUE FOR PREDICTING GRAIN BEHAVIOR
G. W. Lewis, R. F. Fedors, and R. F. Landel *In* APL JANNAF Struct. and Mech. Behavior Working Group, Vol. 1 Apr. 1977 p 87-94 refs (For availability see N78-13220 04-28)
Avail: Issuing Activity

The use of reduced variables to account for the time-temperature dependence of the relaxation modulus is a standard and universally adopted technique in the stress analysis of solid propellant grains. Recent work has suggested that the reduced variable technique can also be used to account for the dependence of the relaxation modulus on the crosslink density of an elastomer system. By combining variables, it is now possible to determine the relaxation modulus as a function of both mechanical and chemical parameters over a long period of time. The problems involved, the pitfalls to be avoided, and suggested techniques to be used in acquiring data are discussed. Author

N78-13229# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
EVALUATION OF CASTOR II MOTOR VERTICAL STORAGE CAPABILITY ON THE LAUNCH PAD
R. V. Mellette *In* APL JANNAF Struct. and Mech. Behavior Working Group, Vol. 1 Apr. 1977 p 95-116 refs (For availability see N78-13220 04-28)
Avail: Issuing Activity

An acceptable limit of 120 days vertical storage capability on the launch pad was established based on the results of grain structural analysis and the successful hanging of a motor for 180 days. Structural analysis results indicated bond integrity and yielded combined gravitational and thermal displacements that gave excellent correlation with measured axial displacement. Poor correlation was obtained between analytical and test radial displacements because of measurement difficulties. Analytical results required the modification of the Automated Viscoelastic Grain Structural Analysis Program to evaluate the combined thermal and gravitation structural responses. A Gravity Subroutine was added which evaluated the structural responses due to motor case ovality and gravity with the motor in the horizontal and vertical attitude. Author

N78-13230# Naval Ordnance Station, Indian Head, Md.
ON THE DEFORMATION OF A NONHOMOGENEOUS PROPELLANT GRAIN UNDER COMBINED LOADING
C. T. Liu *In* APL JANNAF Struct. and Mech. Behavior Working Group, Vol. 1 Apr. 1977 p 117-126 refs (For availability see N78-13220 04-28)
Avail: Issuing Activity

The effects of material nonhomogeneity and grain-case interface debonding on the deformation of a solid propellant grain under pressure and thermal loads were investigated. Radial displacement along the inner surface of the grain was examined since it is closely related to a ballistic anomaly whereby an abrupt rise in chamber pressure occurs shortly after ignition of the rocket motor. A finite element computer program for an axisymmetric problem was used to analyze the propellant grain. The analyzed grain was considered as a layered cylinder. Each layer is made of elastic material with uniform properties through its thickness. The results of the analysis indicate that, for a given loading condition, the distribution of the radial displacement along the inner surface of a multiple layered propellant grain depends on the relative thickness of the individual layers, the distribution of the modulus, and the interfacial debonding length. Author

N78-13231# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLICATION OF THE ENDOCHRONIC THEORY OF VISCOPLASTICITY TO SOLID PROPELLANTS AND SAND-ASPHALT CONCRETE
S. T. J. Peng and K. C. Valanis (Iowa Univ., Iowa City) *In* APL JANNAF Struct. and Mech. Behavior Working Group, Vol. 1 Apr. 1977 p 127-139 refs (For availability see N78-13220 04-28)
Avail: Issuing Activity

Solid propellants, sand-asphalt concrete and hard plastics showed rate sensitive mechanical behavior which, in addition, indicated that these materials have a permanent memory of the strain (or loading) path by which their present state was attained. A constitutive equation was formulated in general three dimensional tensorial form by means of irreversible thermodynamics. By using a very simple analytical form, it was shown that the mechanical behavior of solid propellants and sand-asphalt concrete can be readily described. Author

N78-13232# Utah Univ., Salt Lake City.
DYNAMIC VISCOELASTIC CRACK PROPAGATION
S. R. Swanson *In* APL JANNAF Struct. and Mech. Behavior Working Group, Vol. 1 Apr. 1977 p 141-150 refs (For availability see N78-13220 04-28)
Avail: Issuing Activity

The problem of dynamic constant velocity crack propagation in linear viscoelastic media was examined. Two analytical models of the fracture process were employed, which are the singular line crack model and a model based on a zone of cohesive forces at the crack tip. A solution for the fracture energy balance was obtained for these two models. While the singular line crack model may not be physically appropriate, the cohesive zone model appeared to be generally in agreement with experience. This model predicts significant dynamic effects at much lower velocities than would be predicted based on glassy viscoelastic modulii. Author

N78-13233*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HYDROCARBON GROUP TYPE DETERMINATION IN JET FUELS BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY
Albert C. Antoine 1977 13 p refs Presented at 4th Ann. Meeting of the Federation of Analytical Chem. and Spectroscopy Soc. (FACSS 4), Detroit, Mich., 7-11 Nov. 1977
(NASA-TM-73829; E-9416) Avail: NTIS HC A02/MF A01 CSCL 21D

Thirty-two jet and diesel fuel samples of varying chemical composition and physical properties were prepared from oil shale and coal syncrudes. Hydrocarbon types in these samples were determined by a fluorescent indicator adsorption analysis, and the results from three laboratories are presented and compared. Two methods of rapid high performance liquid chromatography were used to analyze some of the samples, and these results are also presented and compared. Two samples of petroleum-based Jet A fuel are similarly analyzed. Author

N78-13234*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
TRIPLE POINT DETERMINATIONS OF MONOMETHYLHYDRAZINE AND NITROGEN TETROXIDE, 2.2 PERCENT BY WEIGHT NITRIC OXIDE
Irwin D. Smith and Patrick M. Dooge (Lockheed Electronics Co., Inc., Las Cruces, New Mexico) Nov. 1977 16 p refs
(NASA-RP-1013; S-475) Avail: NTIS HC A02/MF A01 CSCL 21I

A series of tests was performed to ascertain the triple points of monomethylhydrazine and nitrogen tetroxide. A laboratory method indicated a triple point for monomethylhydrazine, but tests in a large vacuum chamber indicated that a triple point does not occur in spacelike conditions because the monomethylhydrazine tends to supercool. Instead, an effective freezing point (with agitation) was obtained. New experimental values for liquid monomethylhydrazine vapor pressure were determined for temperatures from 275.2 to 207.6 K. The values were used to derive vapor pressure equations. Tentative values were obtained for the effective freezing point of nitrogen tetroxide spacelike conditions. Author

N78-13235# Naval Air Propulsion Test Center, Trenton, N.J. Propulsion Technology and Project Engineering Dept.
LUBRICITY PROPERTIES OF HIGH TEMPERATURE JET FUEL Final Report
Lawrence Grabel Aug. 1977 47 p refs
(AD-A045467; NAPTC-PE-112) Avail: NTIS HC A03/MF A01 CSCL 21/4

The effects of fuel additives and naturally occurring fuel components and impurities on the lubricity of JP-5 were determined. The ball-on-cylinder machine was used as a lubricity tester. Naturally occurring hydrocarbon compounds had very little effect on the lubricity of JP-5. Corrosion inhibitors, organic acids and nitrogen containing compounds were found to improve lubricity while sulfur compounds, non-acid oxygen containing compounds and anti-oxidants had little or no effect on lubricity. The compounds that were effective lubricity improvers did so by keeping dissolved oxygen from reaching the metal surface of the ball-on-cylinder machine and reacting there. Author (GRA)

N78-13236# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Chemistry.
HIGH ENERGY NITROGEN COMPOUNDS Final Report, 1 Apr. 1975 - 14 Jul. 1977
George A. Olah 14 Jul. 1977 4 p
(Grant DAHC04-75-G-0110)
(AD-A045862; ARO-12915.3-C) Avail: NTIS HC A02/MF A01 CSCL 19/1

The objective of the work was to extend our basic knowledge of nitration, the fundamental reaction producing high energy nitrogen compounds. Studies included exploration of new areas of aliphatic electrophilic nitration, improved preparative routes to known high energy compounds such as TNT and TNB (1-3-5-trinitrobenzene) and safe new methods to prepare O- and nitrogen compounds. Author (GRA)

N78-13237# Kentucky Univ., Lexington. Inst. for Mining and Minerals Research.
PRODUCTION OF AMMONIA USING COAL AS A SOURCE OF HYDROGEN Annual Report
Walden L. S. Laukhuf (Louisville Univ., Ky.) Apr. 1977 49 p refs
(PB-271916/9; IMMR28-PD17-77; AR-2) Avail: NTIS HC A03/MF A01 CSCL 21D

A study was performed to determine an optimum set of operating conditions for a coal gasifier used to provide hydrogen for a 1200-ton per day ammonia synthesis plant. The feedstock was a high sulfur Western Kentucky coal. By using a thermodynamic equilibrium model of a gasifier, it was found that if more steam was sent to the gasifier and less oxygen or air was sent, more hydrogen would be produced. However, based on the amount of hydrogen produced, no optimum operating conditions were determined. Based on economics and the cost to produce one ton of ammonia, optimum gasifier operating conditions were determined. GRA

N78-13238# Sandia Labs., Albuquerque, N. Mex. Explosive Materials Div.
PYROTECHNIC MATERIALS DEVELOPMENT PROGRAM REVIEW MEETING
R. K. Quinn, ed. Apr. 1977 94 p Meeting held 18 Jan. 1977
(Contract EY-76-C-04-0789)
(SAND-77-0471) Avail: NTIS HC A05/MF A01

Programs conducted in Ti/KClO4 and TiH0.65/KClO4 pyrotechnic materials were reviewed. The subjects included chemical and mechanical properties of the starting materials and blends; e.g., electrical resistivity, chemical and mechanical analysis, and compatibility/stability studies; special problems associated with surface analysis of these materials; and results on mathematical modeling of ignition. ERA

N78-13239# Eastlund (Ben) Fusion Systems Co., Rockville, Md.
WORKSHOP ON SYNTHETIC FUELS FROM FUSION
Apr. 1977 86 p refs Workshop held at Palo Alto, Calif., 9 Feb. 1976 Sponsored by the Electric Power Research Inst.
(EPRI-ER-439-SR; Conf-760254) Avail: NTIS HC A05/MF A01

Reasons to pursue a program to define and explore the nonelectrical outputs of fusion reactors are discussed. Meeting fuel shortages, early availability of fusion reactors, and increasing overall efficiency of fusion power plants are among the factors considered. The potential ability of fusion reactors to provide thermal energy at temperatures considerably above those currently available from fission reactors and high temperature applications such as chemical processing, thermochemical dissociation of water, and thermally-enhanced electrolysis of water are included. ERA

N78-13240# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
RESULTS OF L-STAR-INSTABILITY EXPERIMENTS WITH DOUBLE BASE ROCKET PROPELLANTS
R. S. DeBoer and H. F. R. Schoeyer Oct. 1976 93 p refs Prepared jointly with Technol. Lab. RVO-TNO, Rijswijk, Neth.
(VTH-LR-224; TL-R-3050-1) Avail: NTIS HC A05/MF A01

Experiments to detect the sensitivity of double base rocket

propellants for low frequency oscillatory combustion (so-called L-star instability) are described. Two end burning rocket motors with a variable chamber geometry and interchangeable nozzles (generally called L-star burners) were developed and constructed. The best possible means of propellant ignition in the L-star burner was established to be a pyrotechnic lacquer in conjunction with an ignition wire. For various values of the L-star, experiments with ARP and JPN propellants were carried out. In many cases chuffing occurred, and there was a tendency towards a correlation between the occurrence of chuffing and the L-star value. Typical L-star oscillations were observed only a very few times and only for the JPN propellant. It may be concluded that the JPN and ARP double base propellants, even after prolonged storage, are fairly stable as far as L-star oscillations are concerned.
Author (ESA)

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N78-13241*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROCEEDINGS OF THE CONFERENCE ON COAL FEEDING SYSTEMS
15 Sep. 1977 726 p refs Proc. held at Pasadena, Calif., 21-23 Jun. 1977 Sponsored by ERDA
(Contract NAS7-100)
(NASA-CR-155331; JPL-Pub-77-55) Avail: NTIS HC A99/MF A01 CSCL 10B

Development of coal feed systems for coal gasification, fluidized bed combustion, and magnetohydrodynamic applications is discussed. Process operations experience, energy conversion efficiency, and environment effects are among the factors considered. For individual titles, see N78-13242 through N78-13270.

N78-13242*# Energy Research and Development Administration, Pittsburgh, Pa. Energy Research Center.
EXPERIENCE IN FEEDING COAL INTO A LIQUEFACTION PROCESS DEVELOPMENT UNIT **c37**
S. Akhtar, S. Friedman, N. J. Mazzocco, and P. M. Yavorsky *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 41-54 refs (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

A system for preparing coal slurry and feeding it into a high pressure liquefaction plant is described. The system was developed to provide supporting research and development for the Bureau of Mines coal liquefaction pilot plant. Operating experiences are included. J.M.S.

N78-13243*# Petrocarb, Inc., N. Y.
THE PETROCARB PNEUMATIC FEEDING SYSTEM: A PROVEN METHOD FOR FEEDING PARTICULATE SOLIDS AT CONTROLLED RATES **c37**
H. Reintjes *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 55-63 refs (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

An outline of the principal features of the Petrocarb Pneumatic Feeding System is given. Early development and various commercial applications are included. It is concluded that the Petrocarb Injection System is capable of feeding dry solids into most of the processes being developed for utilizing coal. Author

N78-13244*# Energy Research and Development Administration, Pittsburgh, Pa. Synthane Pilot Plant.
COAL PRESSURIZATION AND FEEDING: USE OF A LOCK HOPPER SYSTEM **c37**
R. Lewis, R. R. Santore, and D. Dubis *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 65-72 (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

Operation of a synthane gasifier pilot plant is discussed. The specific problems experienced with the operation of the Petrocarb system at the pilot plant are described along with modifications made to improve its performance. J.M.S.

N78-13245*# Beaumont Birch Co., Pittsburgh, Pa.
COAL GASIFICATION: NEW CHALLENGE FOR THE BEAUMONT ROTARY FEEDER **c37**
J. Stelian *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 73-99 (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

The use of rotary feeders in the coal gasification process is described with emphasis on the efficient conversion of coal to clean gaseous fuels. Commercial applications of the rotary feeder system are summarized. J.M.S.

N78-13246*# Energy Research and Development Administration, Morgantown, W. Va. Energy Research Center.
DEVELOPMENT OF COAL-FEEDING SYSTEMS AT THE MORGANTOWN ENERGY RESEARCH CENTER **c37**
J. M. Hobday *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 101-133 refs (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

Systems for feeding crushed and pulverized coal into coal conversion reactor vessels are described. Pneumatic methods for feeding pulverized coal, slurry feeders, and coal pumps, methods for steam pickup, and a method for drying a water-coal slurry in a steam fluidized bed subsequent to feeding the coal into a reactor vessel are included. Author

N78-13247*# Kamyr, Inc., Glen Falls, N. Y.
COMPARATIVE DESCRIPTION OF COAL FEEDING SYSTEMS FOR FIXED BED PRESSURE GASIFICATION **c37**
E. Funk and R. Reimert (Lurgi Mineraloltechnik GmbH, Frankfurt, West Germany) *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 134-163 (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

Coal feeding systems are discussed which are capable of feeding 20-100 T/H and the range of pressure is up to 100 bar. Most emphasis is placed on dry feeding systems. The systems outlined are subdivided into continuous and intermittent and the influence of each system on lock gas losses and reactor design is shown. Finally a cost estimate is presented which indicates the areas of preferred application and permits conclusions to be drawn regarding the economics of the various systems. Author

N78-13248*# Institute of Gas Technology, Chicago, Ill.
SLURRY PUMPING TECHNIQUES FOR FEEDING HIGH-PRESSURE COAL GASIFICATION REACTORS **c37**
W. G. Bair and P. B. Tarman *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 165-181 Sponsored by ERDA (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

Operating experience in pumping coal and coal char slurries at pressures up to 1500 psig is discussed. The design specifications for the mixing tanks, pumps, piping, and slurry heaters are given along with pressure drop and minimum flow velocity data on water-lignite slurries. Author

N78-13249*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Palo Alto Research Lab.
DEVELOPMENT OF DRY COAL FEEDERS **c37**
J. H. Bonin, D. E. Cantey, A. D. Daniel, Jr., and J. W. Meyer *In* JPL Proc. of the Conf. on Coal Feeding Systems, 15 Sep. 1977 p 195-239 refs (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

Design and fabrication of equipment of feed coal into pressurized environments were investigated. Concepts were selected based on feeder system performance and economic projections. These systems include: two approaches using rotating components, a gas or steam driven ejector, and a modified standpipe feeder concept. Results of development testing of critical components, design procedures, and performance prediction techniques are reviewed. Author

N78-13250*# Ingersoll-Rand Research, Inc., Princeton, N. J.
DRY COAL FEEDER DEVELOPMENT PROGRAM AT INGERSOLL-RAND RESEARCH, INCORPORATED **c37**
D. K. Mistry and T. N. Chen *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 240-284 (For availability

see N78-13241 04-31)
(Contract EX-76-C-01-1794)
Avail: NTIS HC A99/MF A01 CSCL 13I

A dry coal screw feeder for feeding coal into coal gasification reactors operating at pressures up to 1500 psig is described. Results on the feeder under several different modes of operation are presented. In addition, three piston feeder concepts and their technical and economical merits are discussed. Author

N78-13251*# Foster-Miller Associates, Inc., Waltham, Mass.
FOSTER-MILLER'S DEVELOPMENT OF DRY COAL FEED SYSTEMS c37
J. C. Harding *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 285-323 refs (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

Dry coal feeder systems developed for pressurized conversion processes were carried through a laboratory scale development program. These concepts include: (1) a centrifugal solids feeder; (2) a fluidized piston feeder; (3) a linear pocket feeder; and (4) a compacted coal plug feeder. Results of laboratory model testing of all concepts are reviewed. Author

N78-13252*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EVALUATION OF ERDA-SPONSORED COAL FEED SYSTEM DEVELOPMENT c37
R. L. Phen, W. K. Luckow, L. Mattson, D. Otth, and P. Tsou *In its* Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 324-355 (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

Coal feeders were evaluated based upon criteria such as technical feasibility, performance (i.e. ability to meet process requirements), projected life cycle costs, and projected development cost. An initial set of feeders was selected based on the feeders' cost savings potential compared with baseline lockhopper systems. Additional feeders were considered for selection based on: (1) increasing the probability of successful feeder development; (2) application to specific processes; and (3) technical merit. A coal feeder development program is outlined. Author

N78-13253*# GARD, Inc., Niles, Ill.
CONTINUOUS HIGH PRESSURE LUMP COAL FEEDER DESIGN STUDY c37
S. F. Fields *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 359-387 refs (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

A continuous lump coal dry feeder was developed for a pressurized fluidized bed combustor. The approach was to adapt the commercially available Fuller-Kinyon pump to feed coal against a pressure differential of 100 psi or more. The pump was modified and tests performed at various pressure differentials, with differently pitched screws, various screw rotational speeds, and various seal lengths and configurations. Successful operation of the modified Fuller-Kinyon pump was generally limited to pressure differentials of 60 psi or less. Although the results are not conclusive, test data and observations were made that indicated that higher pressure differentials could be attained by further modifications of the test setup. In particular, it is recommended that further testing be performed after replacing the 40-horsepower pump motor presently in the test setup with a motor having a significantly high power rating (thereby allowing pump operation with longer seals and at higher pressure differentials than those tested so far). Author

N78-13254*# Babcock and Wilcox Co., Barberton, Ohio. Power Generation Group.
BABCOCK AND WILCOX'S EXPERIENCE WITH TWO-PHASE FLOW MIXTURES OF COAL AND GAS c37
A. G. Bolumen *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 389-410 (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

The performance of pulverized coal injection systems in operation on blast furnaces is described in terms of application to coal gasification, fluidized bed combustion, and magnetohydrodynamics. J.M.S.

N78-13255*# General Electric Co., Schenectady, N. Y.
PRESSURIZED FEEDING ON THE GEGAS SYSTEM c37
A. H. Furman *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 411-450 refs (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

A continuous process to feed coal directly into a pressurized gasifier is described. Coal fines are heated and mixed with a recycled tar binder and extruded through a novel die system against gasifier pressure. Performance data on a 2 in. system is given and scale up to a larger 6 in. system is described. Author

N78-13256*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COAL EXTRUSION IN THE PLASTIC STATE c37
C. England and P. R. Ryason *In its* Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 451-465 refs (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

Continuous feeding of coal in a compressing screw extruder is described as a method of introducing coal into pressurized systems. The method utilizes the property of many bituminous coals of softening at temperatures from 350 to 425 C. Coal is then fed, much in the manner of common thermoplastics, using screw extruders. Data on the viscosity and extruder parameters for extrusion of Illinois No. 6 coal are presented. Author

N78-13257*# Battelle Columbus Labs., Ohio.
A NOVEL DRY COAL FEEDING CONCEPT FOR HIGH-PRESSURE GASIFIERS c37
H. E. Trumbull and H. C. Davis *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 466-479 (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

A novel dry coal feeding concept was developed for injecting ground coal into high-pressure gasifiers. Significant power savings are projected because the coal is injected directly with a ram and there is no requirement for pumping large volumes of gas or fluid against pressure. A novel feature of the concept is that a new seal zone is formed between the ram and injection tube each cycle. The seal zone comprises a mixture of a small quantity of finely ground coal and a fluid. To demonstrate the feasibility of the concept, coal was injected into a 1000-psi chamber with an experimental device having a 7-1/2-inch-diameter ram and a 28-inch-long stroke. Author

N78-13258*# Solids Flow Control Corp., West Caldwell, N. J.
FEEDING THE FEEDER c37
A. L. Kurylchek *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 480-491 (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

Too often the equipment used to move difficult to handle powdery material from a hopper to process creates a complex of devices whose end result falls short on good performance... simply because equipment design, in many cases, has not kept up with advanced technological concepts in fine powder handling. The Feeder, being the key to an efficient feed system, must be assured a continuous flow from the storage tank...without bridging, arching, spasmodic flow or uncontrolled flushing. The causes and effects of flow problems are discussed and also solutions are offered based on the combination of theoretical and practical experience. Author

N78-13259*# Mardin Engineering Co., Neponset, Ill.
EVACUATION OF COAL FROM HOPPERS/SILOS WITH LOW PRESSURE PNEUMATIC BLASTING SYSTEMS c37
John S. Fischer *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 493-516 (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

The need for an efficient, economical, effective and quiet device for moving coal and other difficult bulk solids was recognized. Thus came the advent of the low pressure pneumatic blasting system - a very efficient means of using a small amount of plant air (up to 125 PSI) to eliminate the most troublesome material hang-ups in storage containers. This simple device has one moving part and uses approximately 3% of the air consumed by a pneumatic vibrator on the same job. The principle of operation

is very simple: air stored in the unit's reservoir is expelled directly into the material via a patented quick release valve. The number, size, and placement of the blaster units on the storage vessel is determined by a series of tests to ascertain flowability of the problem material. These tests in conjunction with the hopper or silo configuration determine specification of a low pressure pneumatic blasting system. This concept has often proven effective in solving flow problems when all other means have failed.
Author

N78-13260*# Energy Research and Development Administration, Morgantown, W. Va. Energy Research Center.
GRAVITY FLOW RATE OF SOLIDS THROUGH ORIFICES AND PIPES **c34**
J. F. Gardner, J. E. Smith, and J. M. Hobday *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 519-536 refs (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 20D

Lock-hopper systems are the most common means for feeding solids to and from coal conversion reactor vessels. The rate at which crushed solids flow by gravity through the vertical pipes and valves in lock-hopper systems affects the size of pipes and valves needed to meet the solids-handling requirements of the coal conversion process. Methods used to predict flow rates are described and compared with experimental data. Preliminary indications are that solids-handling systems for coal conversion processes are over-designed by a factor of 2 or 3. Author

N78-13261*# Energy Research and Development Administration, Morgantown, W. Va. Energy Research Center.
HIGH PRESSURE ROTARY PISTON COAL FEEDER **c37**
J. F. Gardner, H. T. Gencsoy (West Virginia Univ., Morgantown), and D. C. Strimbeck *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 537-549 (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

This feeder concept uniquely combines the functions of solids feeding, metering, and pressurization into one compact system. Success with the rotary-piston concept would provide a lower-cost alternative to lock-hopper systems. The design of the feeder is presented, with special emphasis on the difficult problem of seal design. Initial tests will be to check seal performance. Subsequent tests will evaluate solids-feeding ability. Author

N78-13262*# Argonne National Lab., Ill.
COAL FEED COMPONENT TESTING FOR CDIF **c44**
C. Victor Pearson, Burton K. Snyder, and Thomas E. Fornek *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 550-570 (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 10B

Investigations conducted during the conceptual design of the Montana MHD Component Development and Integration Facility (CDIF) identified commercially available processing and feeding equipment potentially suitable for use in a reference design. Tests on sub-scale units of this equipment indicated that they would perform as intended. Author

N78-13263*# Jenike and Johnson, Inc., Billerica, Mass.
STORAGE AND FEEDING OF COAL **c37**
A. W. Jenike and J. W. Carson *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 571-585 refs (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

Reliable feeding of coal from storage bins to process requires the knowledge of the behavior of coal during flow. The study of the flow of bulk solids was undertaken in the 1950's and led to the development of flow ability testing equipment and of the Mass Flow concept of design for reliable flow. The theory has since been expanded to two-phase, solids-gas system, and has found world wide application in the design of storage and feeding systems. Author

N78-13264*# Bechtel Corp., San Francisco, Calif.
INJECTION OF COAL BY SCREW FEED **c37**
R. Fisher *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 586-603 ref (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 10B

The use of the screw feeder for injecting solids through a 20 to 30 psi barrier is common practice in the cement making industry. An analytical extrapolation of that design, accounting for pressure holding characteristics of a column of solids, shows that coal can be fed to zones at several hundred psi with minimal or no loss of gas. A series of curves showing the calculated pressure gradient through a moving column of solids is presented. Mean particle size, solids velocity, and column length are parameters. Further study of this system to evaluate practicality is recommended. Author

N78-13265*# Mitre Corp., McLean, Va. Metrek Div.
MATERIAL HANDLING SYSTEMS FOR THE FLUIDIZED-BED COMBUSTION BOILER AT RIVESVILLE, WEST VIRGINIA **c37**
J. G. Branam and W. W. Rosborough *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 604-623 (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

The 300,000 lbs/hr steam capacity multicell fluidized-bed boiler (MFB) utilizes complex material handling systems. The material handling systems can be divided into the following areas: (1) coal preparation; transfer and delivery, (2) limestone handling system, (3) fly-ash removal and (4) bed material handling system. Each of the above systems are described in detail and some of the potential problem areas are discussed. A major potential problem that exists is the coal drying system. The coal dryer is designed to use 600 F preheated combustion air as drying medium and the dryer effluent is designed to enter a hot electrostatic precipitator (730 F) after passage through a cyclone. Other problem areas to be discussed include the steam generator coal and limestone feed system which may have operating difficulties with wet coal and/or coal fines. Author

N78-13266*# Rockwell International Corp., Canoga Park, Calif.
ROCKETDYNE'S ADVANCED COAL SLURRY PUMPING PROGRAM **c37**
D. E. Davis, G. S. Wong, and H. H. Gilman (EPRI, Palo Alto, Calif.) *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 624-635 refs (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

The Rocketdyne Division of Rockwell International Corporation is conducting a program for the engineering, fabrication, and testing of an experimental/prototype high-capacity, high-pressure centrifugal slurry feed pump for coal liquefaction purposes. The abrasion problems in a centrifugal slurry pump are primarily due to the manner in which the hard, solid particles contained in the slurry are transported through the hydraulic flow passages within the pump. The abrasive particles can create scraping, grinding, cutting, and sandblasting effects on the various exposed parts of the pump. These critical areas involving abrasion and impact erosion wear problems in a centrifugal pump are being addressed by Rocketdyne. The mechanisms of abrasion and erosion are being studied through hydrodynamic analysis, materials evaluation, and advanced design concepts. Author

N78-13267*# Acton Corp., Cleveland, Ohio.
ACTON MASS FLOW SYSTEM APPLIED TO PFBC FEED **c37**
E. Homburg *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 636-652 (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

Dense phase pneumatic conveying and the Acton Mass Flow concept are defined with emphasis on the specific advantages to the coal and dolomite feed to the Pressurized Fluidized Bed Combustor. The transport and feed functions are explored with a comparison of designing the process for a combined function or for individual functions. The equipment required to accomplish these functions is described together with a typical example of sizing and air or gas requirements. A general outline of the control system required to obtain a uniform feed rate is provided. The condition of the coal and dolomite and conveying gas as required to obtain reliable transport and feed will be discussed.
Author

N78-13268*# Ducon Co., Inc., King of Prussia, Pa. Ducon Fluid Transport Div.
SOME DEVELOPMENTS IN THE FEEDING OF COAL TO FLUIDIZED BED COMBUSTORS **c37**
L. G. Caldwell *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 653-674 (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

Research is being done in the development of fluid bed combustors for high sulphur coal, using limestone or dolomite in the bed for removal of the sulphur. Operating units to date have proven the inadequacies of available material handling techniques for introduction and control of the coal and adsorbent to the beds. Larger units now being contemplated will pose formidable problems in this area. Some of the techniques which were developed for the existing pilot units and novel ideas under consideration for future, large production units are illustrated and described. Author

N78-13269*# Werner and Pfleiderer Corp., Waldwick, N.J.
THE USE OF TWIN SCREW EXTRUDERS FOR FEEDING COAL AGAINST PRESSURES OF UP TO 1500 PSI **c37**
W. Wiedmann and W. A. Mack (Wiedmann and Pfleiderer, Stuttgart, West Germany) *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 689-701 (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

Recent tests with a twin-screw, co-rotating extruder which was successfully used to convey and feed coal against pressures of up to 1500 psi are described. Intermeshing and self-wiping, co-rotating twin-screws give greatly improved conveying and pressure built-up capabilities and avoid hangup and eventual decomposition of coal particles in the screw flights. The conveying action of intermeshing, self-wiping, co-rotating extruder systems approaches that of a positive displacement pump. With this feature, it is possible to maintain very accurate control over all aspects of product conveyance in the extruder, i.e., intake, conveyance and pressure buildup. Author

N78-13270*# Rockwell International Corp., Pittsburg, Pa. Flow Control Div.
LOCK HOPPER VALVES FOR COAL GASIFICATION PLANT SERVICE **c37**
E. Frederick Schoeneweis *In* JPL Proc. of The Conf. on Coal Feeding Systems 15 Sep. 1977 p 702-709 (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

Although the operating principle of the lock hopper system is extremely simple, valve applications involving this service for coal gasification plants are likewise extremely difficult. The difficulties center on the requirement of handling highly erosive pulverized coal or char (either in dry or slurry form) combined with the requirement of providing tight sealing against high-pressure (possibly very hot) gas. Operating pressures and temperatures in these applications typically range up to 1600 psi (110bar) and 600F (316C), with certain process requirements going even higher. In addition, and of primary concern, is the need for reliable operation over long service periods with the provision for practical and economical maintenance. Currently available data indicate the requirement for something in the order of 20,000 to 30,000 open-close cycles per year and a desire to operate at least that long without valve failure. Author

N78-13271# Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering.
AN EXPERIMENTAL INVESTIGATION OF WALL EFFECTS ON SUPERCAVITATING HYDROFOILS OF FINITE SPAN **Progress Report, Oct. 1976 - Sep. 1977**
Michael Rex Maixner Jul. 1977 133 p refs
(Contract N00014-76-C-0358)
(AD-A045769; Rept-83481-3) Avail: NTIS HC A07/MF A01 CSCL 20/4

A geometrically similar family of three supercavitating hydrofoils was tested. The half-span foils were of elliptical planform; the ratio of foil half-span to tunnel height was 1/4 for the small foil, 1/2 for the medium foil, and 3/4 for the largest foil. The tunnel was of square cross section. Lift, drag, moment, tunnel speed, ambient pressure, and cavity pressure were measured for attack angles from 8 to 21 degrees and a variety of ambient pressure settings; cavity length measurements were obtained from photographs. For the small and medium foils, it was sufficient to correct only for the effect on downwash of the images of the trailing vortices. The large foil data, however, required further correction; upon application of the same corrections which were applied to the data for the two smaller foils, the force and moment data for the large foil plotted slightly lower than did the data for the two smaller foils, while the cavity length data for the large foil indicated cavity lengths significantly larger than for either of the theoretical predictions or the cavity length data for the two smaller foils. GRA

N78-13272# Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering.
ADDITION OF THE SPANWISE EFFECT OF GRAVITY TO NUMERICAL CALCULATIONS FOR A SUPERCAVITATING HYDROFOIL OF FINITE SPAN
Charles Gedney Jul. 1977 26 p refs
(Contract N00014-76-C-0358; SR0090101)
(AD-A045760; Rept-83481-1) Avail: NTIS HC A03/MF A01 CSCL 20/4

The spanwise variation in pressure due to gravity (occurring in experimental work) was included in the numerical calculations of a supercavitating hydrofoil of finite span. The effect was negligible on the lift and moment coefficients but a small change in the cavity length was noticed at the foil centroid. The major change was in the cavity shape. The cavity predicted by the new numerical model was longer near the root and shorter near the tip as was expected. Author (GRA)

N78-13273# Kansas Dept. of Transportation, Topeka. Planning and Development Dept.
CRACKED STRUCTURAL CONCRETE REPAIR THROUGH EPOXY INJECTION AND REBAR INSERTION **Interim Report**
F. Wayne Stratton, Roger Alexander, and William Nolting 1977 47 p refs
(PB-270812/5; FHWA/KS/RD-76-2) Avail: NTIS HC A03/MF A01 CSCL 13B

A technique for repairing cracked structural bridge concrete was developed. The method developed consists of sealing the crack, drilling holes at 45 degrees to the deck surface and crossing the crack plane at approximately 90 degrees which is the optimum reinforcement angle, filling the hole and crack plane with epoxy pumped under low pressure, and placing the rebar into the drilled hole in a position to span the crack. A modified injection nozzle was built, and an enlarged vacuum swivel was designed, developed, and built. A mechanical advantage motion detector was designed and built which worked very well and detected fractional, vertical and horizontal motions of 3/64 in. (1.19mm) and recorded them as 3/4 in. (19.1mm) motion. GRA

N78-13274# Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering.
EXPERIMENTS ON A PARTIALLY CAVITATING PLANO-CONVEX HYDROFOIL WITH COMPARISON TO THEORY
James S. Uhlman, Jr. and Chen-Wen Jiang Jul. 1977 29 p refs
(Contract N00014-76-C-0358)
(AD-A045767; Rept-83481-2) Avail: NTIS HC A03/MF A01 CSCL 20/4

A description of some experiments involving a two-dimensional, partially cavitating, plano-convex hydrofoil is presented in this report. The data obtained were compared to two theories for two-dimensional partially cavitating flow; the camber line theory of Geurst and the theory for a plano-convex hydrofoil which included the effects of thickness. The latter theory involves assumptions identical to those of Wade, but the solution is purely numerical, being the determination of the strengths of vortices and sources of a discrete distribution representing the foil and cavity and produces the same results as those of Wade. For a 6% thickness ratio (that of the foil tested) the two theories produce nearly identical results, both of which agree well with measurements for moderate angles of attack. Author (GRA)

N78-13275# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

APL ARCTIC SEV SUBSYSTEM DEVELOPMENT PROGRAM Final Summary Report
T. Thompson and L. L. Warnke Jun. 1977 313 p refs
(Contract N00017-72-C-4401; ARPA Order 1614)
(AD-A045615; APL/JHU/SEV-005; APL/JHU/QM-76-120)
Avail: NTIS HC A14/MF A01 CSCL 01/2

APL conducted a study to define the navigation, terrain surveillance, and communications subsystem requirements in developing a large, high-speed, long-range Arctic-based Surface Effect Vehicle (SEV). During 1970-1974, APL participated in a program to develop the technology required to use the SEV's potential as a high performance platform for Arctic operations. APL's task was to provide the obstacle-avoidance, navigation, and communications concepts and the design information for future Arctic SEV applications. The following APL efforts are discussed: development and evaluation of a 94-GHz obstacle-detection system, conceptual design of a complete terrain-avoidance system, tests and analyses in support of the proposed terrain-avoidance and navigation systems, and preliminary communications system design. The results of an APL study of the general characteristics of SEV's and their proposed missions, and a review of obstacle-avoidance techniques previously developed, are also presented. GRA

N78-13276# National Bureau of Standards, Washington, D. C. Materials and Composites Section.
SURVEY OF USES OF WASTE MATERIALS IN CONSTRUCTION IN THE UNITED STATES
James Roger Clifton, Paul W. Brown, and Geoffrey Frohndorff Jul. 1977 63 p refs Presented at the RILEM Symp. on the Use of Waste Mater. in the Construct. Ind.
(PB-270854/3; NBSIR-77-1244) Avail: NTIS HC A04/MF A01 CSCL 13B

A survey covering the sources, amounts and disposal of major mining, industrial and municipal wastes available in the 48 coterminous states of the United States along with their present and potential uses as construction materials is presented. Wastes from mining, industrial and municipal sources are treated separately and in that order. Wastes from mineral, metallic ore and coal mining operations are studied as well as industrial wastes. A variety of important wastes which have found few markets were described; by-products from coal combustion, which are examples of wastes for which there are growing markets were discussed. GRA

N78-13277# Henry (J. J.) Co., Inc., Arlington, Va.
METRIC CONVERSION STUDY FOR THE MARITIME ADMINISTRATION Final Report
14 Jun. 1977 56 p refs
(Contract MA-6-38087)
(PB-271096/0; MA-SC-723-77116) Avail: NTIS HC A04/MF A01 CSCL 13J

A plan for the conversion to the metric system on the part of the Maritime Administration was developed. Recommendations and interrelationships among the maritime industry for accomplishing these objectives are included. GRA

N78-13278# Louisiana Tech Univ., Ruston. Materials Research Lab.
AN EVALUATION OF GAP-GRADED CONCRETES Final Research, Jul. 1974 - Jan. 1977
William O. Hadley Feb. 1977 133 p refs Sponsored by FHWA and Louisiana Dept. of Transportation and Development
(PB-270638/0; RR-73-1; FHWA/LA-77/73-1) Avail: NTIS HC A07/MF A01 CSCL 13C

A study to compare the behavior of continuously-graded concretes to determine whether or not the gap-graded concrete mixtures were comparable to the continuously-graded concrete mixtures was described. The five factors investigated were: (1) coarse aggregate gradation; (2) water-cement ratio; (3) cement content; (4) fine aggregate content; and (5) length of curing. The fundamental material properties evaluated were compressive strength, modulus of elasticity, tensile strength, Poisson's ratio, and tensile strain, while the properties of the plastic concrete mix which were investigated included slump, density, air content, and workability. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N78-13279 Missouri Univ., Columbia.
CORONA RADIO NOISE UTILIZATION FOR INCIPIENT FAULT DETECTION Ph.D. Thesis
Ghassan Hanna Halasa 1976 247 p
Avail: Univ. Microfilms Order No. 77-15518

The undesirable transmission line radio noise was utilized for incipient fault detection. Radio noise meters were placed on the peripheral sides of the line to monitor the radio noise emanating from the line. The meters relay the information to a central computer. The computer is programmed to calculate radio noise levels via prediction models based on weather data at the location of the measurements. The computer is also programmed to compare the measured and the predicted values; if the measured value is higher than the predicted value, then an incipient fault exists in the location of the measurement. The parameters that influence radio noise levels were discussed, classified and reduced. The results are three radio noise level prediction models that predict radio noise levels in most weather conditions. These models were tested against two operating lines that verified their validity. Dissert. Abstr.

N78-13280 Rice Univ., Houston, Tex.
ANALYSIS OF A CIRCULAR WAVEGUIDE CAVITY LOADED WITH THICK MAGNETIZED FERRITE DISKS Ph.D. Thesis
Joseph Miles Hellums 1977 276 p
Avail: Univ. Microfilms Order No. 77-19257

A complete mode analysis of E-plane waveguide circulator junctions would include a treatment of the flat air-ferrite interface. In order to concentrate on this problem a circular waveguide cavity end-loaded with thick magnetized ferrite disks was considered. To provide a foundation for analysis, the theory of ferrite-filled circular waveguide was extended to include evanescent behavior and solution plots were developed for specific parameters. An experimental cavity was constructed to enable various aspects of the analysis to be checked. An investigation of the unmagnetized ferrite loaded cavity provided predictions that agreed with the experiment and valuable insight into the behavior of the magnetized cavity. Predictions of the longitudinal variation of the r.f. magnetic field for each cavity mode were useful in mode identification. Dissert. Abstr.

N78-13281*# Axiomatix, Marina del Rey, Calif.
STUDY TO INVESTIGATE AND EVALUATE MEANS OF OPTIMIZING THE Ku-BAND COMBINED RADAR/COMMUNICATION FUNCTIONS FOR THE SPACE SHUTTLE Final Report
Charles L. Weber, Waddah K. Alem, and Marvin K. Simon 28 Oct. 1977 355 p refs
(Contract NAS9-14614)
(NASA-CR-151562; R7710-5) Avail: NTIS HC A16/MF A01 CSCL 17B

The Ku band radar system on the shuttle orbiter operates in both a search and a tracking mode, and its transmitter and antennas share time with the communication mode in the integrated system. The power allocation properties and the Costa subloop subcarrier tracking performance associated with the baseline digital phase shift implementation of the three channel orbiter Ku band modulator are discussed. Author

N78-13282*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF THE 12GHz, 200 WATT TRANSMITTER EXPERIMENT PACKAGE FOR THE HERMES SATELLITE
Robert E. Alexovich 1977 34 p refs Presented at Symp. on Hermes (Communications Technol. Satellite) its Performance and Applications, Ottawa, 29 Nov. - 1 Dec. 1977; sponsored by Royal Soc. of Canada, Canadian Dept. of Communications and NASA
(NASA-TM-73804; E-9385) Avail: NTIS HC A04/MF A01

CSCL 17B

Performance characteristics from on-orbit tests of the Transmitter Experiment Package (TEP) for the Hermes Satellite are presented. The TEP consists of a Power Processing System (PPS), an Output Stage Tube (OST) and a Variable Conductance Heat Pipe System (VCHPS), all of which are described. The OST is a coupled-cavity Traveling Wave Tube (TWT) with a Multistage Depressed Collector (MDC) and a stepped velocity-tapered slow wave structure for efficiency enhancement. It has an RF output power of 233 watts and overall efficiency of 50.75 percent at a center band frequency of 12.080 GHz. The PPS provides the required operating voltages, regulation, control and protection for the OST. The VCHPS consists of a fin radiator and three dual-artery stainless steel heat pipes using methanol and a mixture of inert gases. Test results presented include efficiencies, RF output power and body current. A discussion of thermal anomalies which occurred is presented. Author

N78-13283*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A DIGITALLY IMPLEMENTED COMMUNICATIONS EXPERIMENT UTILIZING THE HERMES (CTS) SATELLITE

H. D. Jackson and J. Fiala 1977 20 p refs Presented at Symp. on Hermes (Comm. Technol. Satellite) its Performance and Appl., Ottawa, Ontario, 29 Nov. - 1 Dec. 1977; Sponsored by The Royal Soc. of Canada, Canadian Dept. of Commun., and NASA

(NASA-TM-73827) Avail: NTIS HC A02/MF A01 CSCL 17B

The Hermes (CTS) experiment program made possible a significant effort directed toward new developments which will reduce the costs associated with the distribution of satellite services. Advanced satellite transponder technology and small inexpensive earth terminals were demonstrated as part of the Hermes program. Another system element that holds promise for reduced transmission cost is associated with the communication link implementation. An experiment is described which uses CTS to demonstrate digital link implementation and its advantages over conventional analog systems. A Digitally Implemented Communications experiment which demonstrates the flexibility and efficiency of digital transmission of television video and audio, telephone voice and high-bit-rate data is also described. Presentation of the experiment concept which concentrates on the evaluation of full-duplex digital television in the teleconferencing environment is followed by a description of unique equipment that was developed. Author

N78-13284# IIT Research Inst., Chicago, Ill.

EMC ANALYSIS OF THE PROPOSED AEROSAT VHF SUBSYSTEM WITH CURRENT INBAND COMMUNICATIONS SYSTEMS. VOLUME 2: WORLDWIDE Final Report

J. G. Preis, Jr. May 1977 74 p refs

(Contracts DOT-FA70WAI-175; F19628-76-C-0017; AF Proj. 649E)

(AD-A043904/2; ECAC-PR-75-071-Vol-2; FAA-RD-77-56-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 17/2

Information and guidelines are presented pertaining to the electromagnetic compatibility of ground and airborne equipments in the Aeronautical Mobile VHF Service with the proposed AEROSAT VHF avionics. General guidelines for AEROSAT avionics compatibility with the VHF environment are presented along with predicted interactions with aeronautical mobile VHF equipments in the United States and Canada. Author

N78-13285# ITT Gilfillan, Inc., Van Nuys, Calif.

UNATTENDED/MINIMALLY ATTENDED RADAR STUDY. VOLUME 3: RADAR COSTS Final Report

Aug. 1977 54 p refs

(Contract F30602-76-C-0383)

(AD-A045709; ITTG-TP-0002/L-7018-Vol-3; RADC-TR-77-270-Vol-3) Avail: NTIS HC A04/MF A01 CSCL 17/9

The volume presents the Life Cycle Costs analyses of alternative radar design approaches that could be developed to optimally satisfy requirements for unattended and minimally attended radar operations. The requirements, detailed in the study statement of work, consist of two sets of nominal radar performance parameter goals; one set for the unattended radar (UAR) and a second for the minimally attended radar (MAR). Based on these requirements, alternative radar design approaches were synthesized for both UAR and MAR, and evaluated for reliability, life cycle cost (LCC), and performance. The radar designs recommended for UAR and MAR displayed the greatest potential for optimally satisfying all stated requirements. These designs are detailed in Volume II of the report. The UAR, a 60 nmi 2D radar, automatically outputs target track data that can be remoted to manned logistics nodes and/or ROCCs via narrowband communications links. It provides all altitude surveillance coverage of aircraft targets between 100 and 100,000 feet, and is configurable to be sufficiently reliable to guarantee, to a =90 percent confidence level, failure-free system operation for periods of time from three months to one year. The MAR, a 200 nmi 3D radar, also automatically outputs target track data to logistics nodes and/or ROCCs. GRA

N78-13286# Lockheed Missiles and Space Co., Palo Alto, Calif.

RESULTS OF MEASURING ATMOSPHERIC ABSORPTION OF RADIOWAVES AT THE SLOPE OF THE O2 BAND

A. V. Troitskii 1977 3 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Radiofiz. (USSR), v. 20, no. 8, 1977 p 1239-1241

Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The characteristics of radio wave propagation through the thickness of the earth's atmosphere in the range of the oxygen spin-rotational absorption band were investigated in the frequency range v = 53 - 54 GHz. The vertical radio wave attenuation absorption was determined by the attenuation of solar radiation at different zenith angles as determined by a tunable superheterodyne radiometer. The vertical absorption was determined by numerical integration of the water vapor coefficient with respect to altitude by using results of aerological sounding of the atmosphere. An approximate quantum mechanical formula containing two resonance terms yielded the water vapor absorption coefficient. Results were compared with values of the vertical absorption of molecular oxygen in the atmosphere, calculated both by using the line shape (by means of kinetic equation and the Reber line widths) in the continuous curve and by the Rosenkrantz absorption theory. A.R.H.

N78-13287*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

UNIPOLAR PULSE AND BIPOLAR NOISE TESTING OF WIDEBAND SIGNAL NOISE CONDITIONER (MC476-0132-0034)

J. E. Harris Oct. 1977 69 p refs

(Contract NAS9-15200)

(NASA-CR-151569; LEC-10628) Avail: NTIS HC A04/MF A01 CSCL 17B

Information is presented on performance characteristics of the shuttle orbiter wideband signal conditioner when subjected to special types of input signals. Design analysis of the signal flow path through the signal conditioning amplifier was performed followed by actual testing of the amplifier with various signal inputs. Results indicate that the signal conditioner should perform acceptably if the shuttle orbiter flight vibration signal levels are in accord with preflight predictions. Author

N78-13288# IIT Research Inst., Annapolis, Md.

EMC ANALYSIS OF THE PROPOSED AEROSAT VHF SUBSYSTEM WITH CURRENT INBAND COMMUNICATIONS SYSTEMS. VOLUME 1: USA AND CANADA Final Report

Frederick M. Slay May 1977 111 p refs 2 Vol.

(Contracts F19628-76-C-0017; DOT-FA70WAI-175)

(AD-A044004; ECAC-PR-75-071-Vol-1; FAA-RD-77-56-1) Avail: NTIS HC A07/MF A01 CSCL 17/2

Information and guidelines are presented pertaining to the electromagnetic compatibility (EMC) of ground and airborne equipments in the Aeronautical Mobile VHF Service with the proposed AEROSAT VHF avionics. Volume I provides general guidelines for AEROSAT avionics compatibility with the VHF environment and predicted interactions with aeronautical mobile VHF equipments in the United States and Canada. Volume II addresses the worldwide VHF environment. The frequency bands

considered are 125.4-126.0 MHz and 131.4-132.0 MHz. The analysis is based on the VHF frequency assignments in use when the study was performed (1975); co-channel operation of AEROSAT and air traffic control (ATC) stations is not considered. Author (GRA)

N78-13289# Physical Dynamics, Inc., McLean, Va.
THE MAGNETIC FIELD AND MAGNETIC FIELD GRADIENTS OF THE NUC OCEANOGRAPHIC RESEARCH TOWER Final Technical Report, Jan. - Dec. 1976
George H. Gillespie and Walter N. Podney Griffiss AFB, N. Y. RADC Mar. 1977 63 p refs
(Contract F30602-72-C-0494; ARPA Order 1649)
(AD-A045161; PD-76-109; RADC-TR-77-101; FTR-2) Avail: NTIS HC A04/MF A01 CSCL 17/6

Measurements were made of the ambient magnetic field and magnetic field gradients near the Naval Undersea Center (NUC) Oceanographic Research Tower. This report summarizes the experiment and its results. The NUC Tower is located approximately 0.7 miles off the California Coast, near San Diego, and is the proposed site for the shallow water trials of the ARPA Internal Wave Magnetic Sensing (IWMS) experiment. The measurements described here were made in order to determine accurately the magnetic field and associated gradients of the NUC tower, so that their significance as a possible source of noise and interference during the IWMS experiment may be assessed. An analytic model of the magnetic field of the NUC tower which accurately describes the field and associated gradients is also described. GRA

N78-13290# Armed Forces Radiobiology Research Inst., Bethesda, Md.
EXTREMELY LOW FREQUENCY (ELF) VERTICAL ELECTRIC FIELD EXPOSURE OF RATS: IRRADIATION FACILITY
N. S. Matthewson, S. A. Oliva, G. M. Oosta, and A. P. Blasco May 1977 53 p refs
(AD-A045080; AFRRI-TN77-2) Avail: NTIS HC A04/MF A01 CSCL 06/18

An extremely low frequency (ELF) vertical, electric field irradiation facility consisting of six identical exposure chambers is described. This facility simulates the vertical electric field radiated from the U. S. Navy's proposed ELF Communications System, designed to establish worldwide communication with our submarine fleet. This irradiation facility is designed to study the possible bioeffects of ELF on 96 rats equally divided among the six exposure chambers and individually housed in specially modified nonmetallic cages. These cages are designed to minimally perturb the exposure field and provide accurate means to measure food and water consumption. Each exposure chamber can be independently operated up to field strengths of 1000 V/m (RMS) at any sinusoidal ELF frequency. At 45 Hz, the frequency chosen for this research, chamber cross talk is less than -60 db and the vertical electric field uniformity within the exposure area is + or - 5 percent. A complete description of the ambient 60-Hz electric and magnetic fields is presented. This project was sponsored by the U. S. Naval Medical Research and Development Command, contract number XSB09.
Author (GRA)

N78-13291# Armed Forces Radiobiology Research Inst., Bethesda, Md.
MICROWAVE EXPOSURE ARRAY: IMPROVED FIELD MEASUREMENTS
S. A. Oliva and G. N. Catravas Apr. 1977 15 p refs
(AD-A045142; AFRRI-TN77-1) Avail: NTIS HC A02/MF A01 CSCL 06/18

Improved field measurements for Styrofoam and Plexiglas cages and a microwave exposure array previously designed and constructed at AFRRI are described. A new miniature isotropic electric field probe designed by the Bureau of Radiological Health was used. The new measurements demonstrated the effectiveness of the cages for microwave research. The microwave exposure array was shown to provide equal average power density to all exposed animals to within + or - 5 percent. Author (GRA)

N78-13292# Naval Underwater Systems Center, Newport, R. I. Weapon Systems Dept.
COLLECTED PAPERS ON LOW FREQUENCY ELECTROMAGNETIC DIPOLE SCATTERING FROM CONDUCTING OBJECTS IN THE OCEAN
Donald M. Bolle and Ronald A. Bowden 30 Sep. 1977 24 p refs Presented at IEEE Oceans Conf., 1972, 1973, 1974, and 1976
(AD-A045236; NUSC-TD-5438) Avail: NTIS HC A02/MF A01 CSCL 20/14

This document, a collectioq of papers reprinted from OCEANS '72, '73, '74, and '76, traces the development of work conducted by the authors on electromagnetic signatures of smooth conducting objects immersed in the ocean. The papers summarize the successful efforts in applying physical optics approximation techniques to a broad class of problems. GRA

N78-13293# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
ON THE SPEED OF PROPAGATION OF WAVES IN A DEFORMED COMPRESSIBLE ELASTIC MATERIAL
K. N. Sawyers and R. S. Rivlin Jul. 1977 24 p refs
(Contract N00014-76-C-0235)
(AD-A045051; CAM-100-28) Avail: NTIS HC A02/MF A01 CSCL 20/14

A sinusoidal wave of infinitesimal amplitude is propagated in an isotropic compressible elastic material subjected to a static pure homogeneous deformation. Necessary and sufficient conditions are obtained for the speed of propagation to be real in the case when the direction of propagation is parallel to a principal plane of the static deformation. Author (GRA)

N78-13294# Harry Diamond Labs., Adelphi, Md.
SOURCE-REGION EMP COUPLING RELATED TESTS: RECTANGULAR GEOMETRY
John F. W. Dietz, George Merkel, and Daniel J. Spohn Sep. 1977 32 p refs Sponsored jointly by DNA and Army Mater. Develop. and Readiness Command
(AD-A045839; HDL-TM-77-23) Avail: NTIS HC A03/MF A01 CSCL 20/3

This report describes a series of source-region EMP experiments. Measured data are compared with pretest calculations of the predicted responses of simple rectangular gamma-thick and gamma-thin structures that were exposed to ionizing radiation. Predicted values of Compton current also are compared with data obtained by using a Compton diode and Rogowski coils in collimated and uncollimated configurations. GRA

N78-13295# Rome Air Development Center, Griffiss AFB, N.Y.
A THEORETICAL INVESTIGATION OF THE RECTANGULAR MICROSTRIP ANTENNA ELEMENT
Anders G. Derneryd Jun. 1977 26 p refs
(AD-A045775; RADC-TR-77-206) Avail: NTIS HC A03/MF A01 CSCL 09/5

A theoretical treatment of the rectangular microstrip radiating element has been performed. The element has been modeled as a line resonator with radiation taking place at the open-circuited ends. With this simplified model, the input impedance and the far-fields have been calculated for different resonance modes. The interaction between the radiating ends will effect the input impedance and this has been considered by defining a mutual conductance. Also, a mutual conductance between microstrip elements has been expressed in far-field quantities and plotted as a function of spacing along the E- and H-planes. The directivity of an isolated element has been calculated as the directivity of one radiating end times the contribution due to the array factor.
Author (GRA)

N78-13296# Rome Air Development Center, Griffiss AFB, N.Y.
SLOTTED WAVEGUIDE SHAPED BEAM ANTENNA AT Ku BAND Report, 1 Nov. 1975 - 31 Aug. 1977
Robert V. McGahan Jun. 1977 19 p refs
(AF Proj. 4600)
(AD-A045586; RADC-TR-77-205) Avail: NTIS HC A02/MF A01 CSCL 01/4

A Ku band slotted waveguide antenna having a cosecant squared radiation pattern is described. The antenna was designed and constructed by means of a method utilizing displaced, inclined, shunt slots in the broad face of WR 62 waveguide. A gain of 12 db at 15.84 GHz was measured, with crosspolarization rejection

of 20 db. Design equations and curves are included.
Author (GRA)

N78-13297# ITT Gilfillan, Inc., Van Nuys, Calif.
UNATTENDED/MINIMALLY ATTENDED RADAR STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report
Aug. 1977 12 p refs
(Contract F30602-76-C-0383)
(AD-A045702; ITTG-TP-0002/L-7018-Vol-1; RADC-TR-77-270-Vol-1) Avail: NTIS HC A02/MF A01 CSCL 17/9

This executive summary presents an overview of a study of alternative radar design approaches that could be developed to optimally satisfy requirements for unattended and minimally attended radar operations. The requirements, detailed in the study statement of work, consist of two sets of nominal radar performance parameter goals; one set for the unattended radar (UAR) and a second for the minimally attended radar (MAR). Based on these requirements, alternative radar design approaches were synthesized for both UAR and MAR, and evaluated for reliability, life cycle cost (LCC), and performance. The radar designs recommended for UAR and MAR displayed the greatest potential for optimally satisfying all stated requirements. These designs are detailed in Volume II of the report. The UAR, a 60 nmi 2D radar, automatically outputs target track data that can be remoted to manned logistics nodes and/or ROCCs via narrowband communications links. It provides all altitude surveillance coverage of aircraft targets between 100 and 100,000 feet, and is configurable to be sufficiently reliable to guarantee, to a =90 percent confidence level, failure-free system operation for periods of time from three months to one year. The MAR, a 200 nmi 3D radar, also automatically outputs target track data to logistics nodes and/or ROCCs. It provides all altitude 3D coverage of aircraft targets between 100 and 100,000 feet, and is configurable to be sufficiently reliable to guarantee, to a =90 percent confidence level, failure-free system operation for periods of time from five days to 0.5 month. GRA

N78-13298# ITT Gilfillan, Inc., Van Nuys, Calif.
UNATTENDED/MINIMALLY ATTENDED RADAR STUDY. VOLUME 2: RADAR DESIGNS Final Report, 6 Aug. 1976 - 6 Jan. 1977
Aug. 1977 314 p refs
(Contract F30602-76-C-0383)
(AD-A045543; ITTG-TP-0002/L-7018-Vol-2; RADC-TR-77-270-Vol-2) Avail: NTIS HC A14/MF A01 CSCL 17/9

This report presents results of a study of alternative radar design approaches that could be developed to optimally satisfy requirements for unattended and minimally attended radar operations. The requirements, detailed in the study statement of work, consist of two sets of nominal radar performance parameter goals one set for the unattended radar (UAR) and a second for the minimally attended radar (MAR). Based on these requirements, alternative radar design approaches were synthesized for both UAR and MAR, and evaluated for reliability, life cycle cost (LCC) and performance. The radar designs recommended for UAR and MAR displayed the greatest potential for optimally satisfying all stated requirements. These designs are detailed in Volume II of the report. The UAR, a 60 nmi 2D radar, automatically outputs target track data that can be remoted to manned logistics nodes and/or ROCCs via narrowband communications links. It provides all altitude surveillance coverage of aircraft targets between 100 and 100,000 feet, and is configurable to be sufficiently reliable to guarantee, to a >90 percent confidence level, failure-free system operation for periods of time from three months to one year. The MAR, a 200 nmi 3D radar, also automatically outputs target track data to logistics nodes and/or ROCCs. It provides all altitude 3D coverage of aircraft targets between 100 and 100,000 feet, and is configurable to be sufficiently reliable to guarantee, to a >90 percent confidence level, failure-free system operation for periods of time from five days to 0.5 month. Volume II presents alternative approaches investigated and details the radar designs recommended. GRA

N78-13299# General Electric Co., Syracuse, N.Y. Heavy Military Electronic Systems.
DETECTABILITY OF LINEAR FM PULSES TRANSMITTED THROUGH A RANDOM MEDIUM
S. M. Garber 1966 24 p refs Presented at NATO-Marina Italiana Advanced Study Inst. on Stochastic Problems in Underwater Sound Propagation, Lerici, Italy, 18-23 Sep. 1967
(AD-A045662) Avail: NTIS HC A02/MF A01 CSCL 17/1

The objective of the work to be described is to determine some of the implications of medium distortion on waveform and processor design for active echo-ranging sonar. In particular, the questions of bandwidth and duration of linear FM signals are considered, as well as various combinations of coherent and incoherent processing. Sonar echos are modeled as a multiplicity of discrete arrivals, the arrival time (range), Doppler shift and amplitude being chosen at random from specified probability densities. Noise is modeled as white with Gaussian amplitude statistics, and reverberation as having Gaussian amplitude statistics but the power spectrum of the transmitted signal. With these models, computer simulation is employed to examine the detectability of echos produced by the transmission of linear FM pulses of various bandwidths and durations. The processor consists of a correlator followed by various amounts and shapes of incoherent integration. Monte Carlo techniques are used to generate ROC curves, showing the probability of an echo being detected on a given ping vs the probability of a false detection in the absence of an echo, with input signal-to-noise ratio or signal-to-reverberation ratio as a parameter. The conclusion reached from these results is that best detection performance is obtained by use of a pulse with as much bandwidth as system constraints will permit. GRA

N78-13300# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
ANALYSIS OF SATELLITE DATA ON PRECIPITATING PARTICLES IN COORDINATION WITH ELF PROPAGATION ANOMALIES Annual Report, period ending 14 Jun. 1977
William L. Imhof, Trygue R. Larsen, Joseph B. Reagan, and Edward E. Gaines 30 Jun. 1977 124 p refs
(Contract N00014-75-C-0954)
(AD-A045606; LMSC-D560323) Avail: NTIS HC A06/MF A01 CSCL 20/14

Based on energetic particle measurements from a satellite, a study has been made of the effects of particle precipitation into the atmosphere on the transmission of ELF signals. Coordinated exercises were conducted between satellite measurements of the precipitating particles and ELF transmissions between the U.S. Navy Wisconsin Test Facility and receiving stations in Maryland, Greenland, Norway, and Italy. Significant fluxes of precipitating electrons were often measured with the Lockheed payload on the polar-orbiting satellite 1972-076B. Based on the fluxes, energy spectra, and pitch-angle distributions of the particles, ion-pair production profiles were calculated and electron density profiles subsequently obtained with application of known effective electron loss rates. From the coordinated data, correlative studies between signal strengths and electron density profiles were performed with use of an ELF wave-guide-mode computer program developed at the Naval Ocean Systems Center. With the inclusion of data from several stations, the transmission signal strength could be studied simultaneously under a variety of ionospheric conditions. The wave-guide computer program calculations indicated that energetic particle precipitation events may cause a signal enhancement or degradation, depending upon where the disturbance is occurring along the path. The consistent occurrence during electron precipitation events of signal strength anomalies in either direction is supported by the coordinated satellite/ELF station measurements. GRA

N78-13301# Weapons Research Establishment, Salisbury (Australia).
SOME VARIATIONS IN VLF DIURNAL SHIFT
K. J. W. Lynn Mar. 1977 17 p refs
(AD-A045449; WRE-TR-1764(A)) Avail: NTIS HC A02/MF A01 CSCL 20/14

VLF diurnal shifts of differing magnitude have been observed at the same frequency over paired propagation paths of nearly equal length. Computed diurnal shifts demonstrate that a small variation in modal interference spacing with path azimuth may explain these results. Author (GRA)

N78-13302# Naval Weapons Center, China Lake, Calif. Electronic Warfare Dept.

AUTOMATIC GAIN CONTROL: A PRACTICAL APPROACH TO ITS ANALYSIS AND DESIGN

Richard Smith Hughes Aug. 1977 114 p refs
(AD-A045608; NWC-TP-5948) Avail: NTIS HC A06/MF A01 CSCL 09/1

Automatic gain control (AGC) provides the capability to normalize wide input signal variations into predictable small output variations. AGC has application to radio, television, and radar systems. The AGC loop will normalize the received signal in a radio to keep the sound level constant and independent of input signal level; in a radar receiver the AGC loop will normalize the input signal prior to direction-of-arrival-signal processing. It is not uncommon for an AGC loop to compress a 60-dBm input dynamic range into a 1-dBm output variation. This book covers all aspects of AGC design; from static regulation to dynamic regulation (modulation reduction) to loop bandwidth and rise time. The theory presented is practical and is aimed at the working level engineer or technician. All equations are verified with practical design examples, and although the material addresses radar applications, the theory and techniques are valid for any AGC system. Author (GRA)

N78-13303# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sciences.

A PROGRAM DESCRIPTION OF ORBIT-PRINTS: CONTOURS OF POWER DENSITY AT THE GEOSTATIONARY ORBIT

W. A. Kissick and D. N. Rebol Jun. 1977 95 p
(PB-271815/3; OTR-77-126) Avail: NTIS HC A05/MF A01 CSCL 17B

A computer program is described which calculates the contours of terrestrial-emitter power density measured at or near the geostationary orbit. The program calculates the power density for an array of points located on the inside surface of a sphere described by the geostationary orbit. The theory and calculations used assumed free-space propagation. The geometry allows for arbitrary aiming of the emitter antenna, and several antenna patterns for the terrestrial emitters are included as subroutines of the computer program. The primary output of the program is a computerized plot of contour intervals of power density. The program was written in FORTRAN 4 for the U.S. Department of Commerce, Boulder Laboratories' computer. GRA

N78-13304# Stanford Research Inst., Menlo Park, Calif.

ACTIVE NETWORK TECHNIQUES FOR IMPROVING ANTENNA PERFORMANCE Final Report, 26 May 1975 - 25 May 1977

Alfred J. Bahr 12 Sep. 1977 17 p refs
(Contract DAHC04-75-C-0023)
(AD-A045728; ARO-13058.3-EL) Avail: NTIS HC A02/MF A01 CSCL 09/5

This study was concerned with improving the performance of electrically small antennas through the use of active-network techniques. Only antennas for the range 30-80 MHz were considered, and means were sought for reducing the noise figure of a receiving system employing such an antenna. Two types of active coupling networks were studied: negative-immittance converters (NIC), and feedback amplifiers. The results obtained show that an FET with feedback appears useful, whereas an NIC is impractical because of its excessive noise and its high sensitivity to changes in circuit and bias parameters.
Author (GRA)

N78-13305# Battelle Columbus Labs., Ohio.

STANDARD ELECTRONIC MODULE RADAR LIFE CYCLE COST STUDY Final Report, 1 Jun. - 30 Nov. 1976

Thomas R. Cork and Robert H. Blazek Jul. 1977 70 p refs
(Contract F33615-76-C-1336)
(AD-A045474; AFAL-TR-77-25) Avail: NTIS HC A04/MF A01 CSCL 17/9

The Standard Electronic Module Program (SEMP) has been employed as a standardized design technology and logistics support concept by the U.S. Navy since 1962. From its original usage in shipboard systems, development of the SEMP has expanded to other electronic missions and to other services. The U.S. Air Force Avionics Laboratory initiated in 1974 an effort to evaluate the use of SEMP technology in the Air Force's avionics scenario. Under AFAL funding, the Naval Avionics Facility - Indianapolis has designed and fabricated an airborne weather-beacon-navigation radar system. Officially identified as the AN/APS-129, this radar is designed to perform the same function as the APN-59/B radar in C130, C135, and C141 aircraft. The purpose of this report is to present the results of an independent research program conducted to explore the benefits of SEMP technology as it is represented in the prototype APS-129 system. For analysis purposes, benefits are quantified in the framework of a retrofit program to replace the APN-59/B. GRA

N78-13306# Raytheon Co., Wayland, Mass. Advanced Development Lab.

R AND D EQUIPMENT INFORMATION REPORT. VOLUME 1: WEATHER RADAR TRANSPONDER. VOLUME 2: GROUND-CLUTTER CANCELLER Final Report, 1 Oct. 1976 - 28 Feb. 1977

Ronald K. VanderKruik and Anthony J. Jagodnik, Jr. Apr. 1977 105 p refs
(Contract F19628-76-C-0297)
(AD-A045589; ER77-4128-Vol-1; ER77-4128-Vol-2; AFGL-TR-77-0171-Vol-1; AFGL-TR-77-0171-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 17/9

This document describes two distinct equipments developed for use with meteorological radar systems. The Weather Radar Transponder calibrates a radar system in amplitude for both directions of travel from a remote location and additionally verifies its doppler response from an on-site location. The Ground Clutter Canceller removes unwanted ground returns and feed-through which would otherwise corrupt estimates of doppler spectral mean and width obtained by a Pulse-Pair Processor.
Author (GRA)

N78-13307# Sandia Labs., Albuquerque, N. Mex.

ATMOSPHERIC PROPAGATION CONSTRAINTS ON MICROWAVE POWER TRANSMISSION

W. D. Brown Apr. 1977 22 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0158) Avail: NTIS HC A02/MF A01

The restrictions imposed by breakdown of the air and by ionospheric, gaseous, and hydrometeor attenuation on the power flux of microwaves that can be transmitted through the atmosphere are examined. Values of the maximum power flux that can be transmitted are presented for CW signals and for pulsed signals with pulse widths equal to 0.05, 0.1, 1.0, and 5.0 microseconds. These values were calculated for altitudes ranging from sea level to about 100 km and for microwave frequencies of 0.3, 1, and 30 GHz. The maximum transmittable power flux increases with increasing microwave frequency, is larger for pulsed-mode operation than for CW operation, and increases with decreasing pulse duration. The incremental attenuation of microwaves propagating through the ionosphere as a function of altitude is presented for 0.3 and 1 GHz. Since ionospheric attenuation is proportional to 1/(frequency) squared, it is significant only at frequencies below about 100 MHz. Attenuation resulting from propagation through rain is presented as a function of frequency, rain intensity, and elevation angle. ERA

N78-13308# Marconi Communication Systems Ltd., Chelmsford (England).

STUDY OF SATELLITE COMMUNICATIONS SYSTEM SERVING OFF-SHORE OIL AND GAS EXPLOITATION ACTIVITIES IN EUROPEAN SEA AREAS, VOLUME 1 Final Report

Paris ESA Jun. 1977 73 p refs Original contains color illustrations 5 Vol.
(Contract ESA-2701/76-F-WMT(SC))
(CWJ1/C-640003-Vol-1; ESA-CR(P)-972-Vol-1) Avail: NTIS HC A04/MF A01

The provision of a satellite service based on the ECS to meet communication needs of the European offshore energy industry through the 1980's, is discussed. The potential requirement for satellite channels is established. Various types of offshore structure are identified and projections made of the number of structures likely to be deployed in the ECS-1 offshore coverage area through the 1980's. A detached color map of North Sea

offshore leases was included in the original document but not made available on microfiche. ESA

N78-13309# Marconi Communication Systems Ltd., Chelmsford (England).
STUDY OF SATELLITE COMMUNICATIONS SYSTEM SERVING OFF-SHORE OIL AND GAS EXPLOITATION ACTIVITIES IN EUROPEAN SEA AREAS, VOLUME 2 Final Report
Paris ESA Jun. 1977 421 p refs 5 Vol.
(Contract ESA-2701/76-F-WMT(SC))
(CWJ1/C-640003-Vol-2; ESA-CR(P)-972-Vol-2) Avail: NTIS HC A18/MF A01

The provision of a satellite service based on the European Communications Satellite to meet communications needs of the European offshore energy industry through the 1980's is described. Transmission systems are reviewed, and a complete theoretical discussion of possible modulation methods as a basis for the overall system performance assessment is presented. ESA

N78-13310# Marconi Communication Systems Ltd., Chelmsford (England).
STUDY OF SATELLITE COMMUNICATIONS SYSTEM SERVING OFF-SHORE OIL AND GAS EXPLOITATION ACTIVITIES IN EUROPEAN SEA AREAS, VOLUME 3 Final Report
Paris ESA Jun. 1977 199 p refs 5 Vol.
(Contract ESA-2701/76-F-WMT(SC))
(CWJ1/C-640003-Vol-3; ESA-CR(P)-972-Vol-3) Avail: NTIS HC A09/MF A01

The provision of a satellite service based on the European Communications Satellite to meet communication needs of the European offshore energy industry through the 1980's is discussed. Environmental conditions are studied. Topics covered include atmospheric attenuation in the 11 to 14.5 GHz band, meteorological environment, and local environmental factors on offshore platforms. A parametric design and cost analysis is presented for offshore and shore stations. Major hardware design conclusions are reduced, particularly in regard to the offshore antenna and pointing control subsystem. ESA

N78-13311# Marconi Communication Systems Ltd., Chelmsford (England).
STUDY OF SATELLITE COMMUNICATIONS SYSTEM SERVING OFF-SHORE OIL AND GAS EXPLOITATION ACTIVITIES IN EUROPEAN SEA AREAS, VOLUME 4 Final Report
Paris ESA Jun. 1977 127 p 5 Vol.
(Contract ESA-2701/76-F-WMT(SC))
(CWJ1/C-640003-Vol-4; ESA-CR(P)-972-Vol-4) Avail: NTIS HC A07/MF A01

The provision of a satellite service based on the European Communication Satellite (ECS) to meet communication needs of the European offshore energy industry through the 1980s is discussed. Predicted channel requirements for the proposed ECS fixed oil platform communications service and for the Marots mobile service are examined separately. An optimization of the overall communication system centered on ECS was carried out involving numerous tradeoffs. The preferred systems concept is described and illustrated. Integration aspects of the proposed ECS communications service with other currently used telecommunications services available to the offshore user are discussed. ESA

N78-13312# Marconi Communication Systems Ltd., Chelmsford (England).
STUDY OF SATELLITE COMMUNICATIONS SYSTEM SERVING OFF-SHORE OIL AND GAS EXPLOITATION ACTIVITIES IN EUROPEAN SEA AREAS. VOLUME 5: SUMMARY Final Report
Paris ESA Jun. 1977 61 p 5 Vol.
(Contract ESA-2701/76-F-WMT(SC))
(CWJ1/C-640003-Vol-5-Summ; ESA-CR(P)-972-Vol-5-Summ) Avail: NTIS HC A04/MF A01

A summary of a study concerning the provision of satellite services based on the European Communication Satellite to meet communications needs of the European offshore energy industry through the 1980's is presented. The potential requirement for satellite channels is established. An atmospheric propagation model is discussed in terms of topographical and climatic factors governing the attenuation of satellite-earth paths in the 11 to 14.5 GHz band. Environmental factors are related to antenna design. Results of the transmission system analysis are summarized, and the outcome of certain of the system optimization investigations is reported. The preferred offshore terminal configuration is described. ESA

N78-13313# European Space Agency, Paris (France).
MICROWAVE SCATTERING FROM THE SEA SURFACE
Volker Stein Oct. 1977 88 p refs Transl. into ENGLISH of 'Zur Streuung von Mikrowellen an Meeresoberflaechen', DFVLR, Oberpfaffenhofen, West Ger. Report DRL-FB-77-09, 23 Mar. 1977 Original report in GERMAN previously announced as N77-32373 Original German report available from DFVLR, Cologne DM 27.40
(ESA-TT-422; DLR-FB-77-09) Avail: NTIS HC A05/MF A01

In sensing the ocean surface with microwave methods from a remote platform such as an aircraft, satellite, or Spacelab, there arises the problem of describing, in an analytic form, the interaction between electromagnetic wave and water wave. The total electrodynamic processes can be represented in compact form by the radar cross section. For the derivation of this quantity a classification of surface models with different roughness scales is carried out. This facet model is explained in more detail because it is suited to describe composite surfaces and hydrodynamic interaction processes. The most important constituent in this model is the average radar cross section per unit area of a statistical surface with small scale roughness. This quantity is derived for the case of a perfectly conducting time invariant surface by solving the boundary value problem under approximate realization of the boundary condition. Only zero-order and first-order terms in the random coefficients of the surface function are taken into account. The extended radar cross section formulas are cited from literature for a lossy and a time varying surface, as well as for depolarization phenomena. Author (ESA)

N78-13314# Office of Telecommunications, Boulder, Colo. Policy Research Div.
URBAN CATV DISTRIBUTION PLANT, CURRENT COST AND TECHNOLOGY
M. B. Gray, J. W. Hart, A. C. Miller, and G. G. Ax Jun. 1977 60 p refs
(PB-271213/1; OTR-77-124) Avail: NTIS HC A04/MF A01 CSCL 17B

A background study of the costs and technologies of urban CATV distribution systems and of the demographic environment in which these systems must be constructed is presented. Quantitative as well as qualitative urban characteristics and constraints were highlighted. These include high population density; multi-dwelling structures; paved and congested rights-of-way; requirements that utility and (and CATV) cables be installed in underground conduit or buried; and high labor costs in a labor-intensive construction process. This information is followed by a study of transmission and construction technologies and costs which are applicable to current urban broadband distribution systems. GRA

N78-13315# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sciences.
TECHNIQUES FOR THE EVALUATION OF PROPOSED UHF TV DROP-INS
George A. Hufford Jul. 1977 161 p refs
(Contract FCC-RA-0017)
(PB-271212/3; OTR-77-112) Avail: NTIS HC A08/MF A01 CSCL 17B

Various techniques, mostly computer aided which can be used to evaluate specific proposals for drop-ins are described. A set of restrictions that might be imposed on the transmitter in order to keep interference to the existing stations to a tolerable level were defined. How to find a region within which a drop-in could be located and how one might try to choose the precise location so as to maximize the potential audience were illustrated. Terrain shielding and what effect it could have on the evaluation process were discussed. All of the suggested techniques are illustrated by the specific example of a proposed Channel 8 drop-in for Knoxville, Tennessee. It is concluded that such a

drop-in is technically possible, although it would be subject to more than the usual set of restrictions. GRA

N78-13316# National Bureau of Standards, Washington, D. C.
NEAR-FIELD ANTENNA MEASUREMENTS ON A CYLINDRICAL SURFACE: A SOURCE SCATTERING-MATRIX FORMULATION
Arthur D. Yaghjian Jul. 1977 40 p refs
(PB-271687/6; NBS-TN-696) Avail: NTIS HC A03/MF A01 CSCL 09E

The theory for probe-corrected measurement of antennas by scanning on a circular cylindrical surface enclosing the test antenna in the near-field is formulated from a source scattering matrix description of the test and probe antennas. The basic transmission formula is derived without recourse to reciprocity, and from a common center approach which separates as an isolated problem the probe characterization and transformation. Moreover, it is shown how an experimental technique can, in principle, determine the required transformed probe coefficients without the use of addition theorems. Computer inversion of the transmission formula is accomplished accurately and efficiently with the aid of the sampling theorem and FFT algorithm. GRA

N78-13317# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON TELECOMMUNICATIONS POLICY, RESEARCH AND DEVELOPMENT, NO. 22
29 Nov. 1977 50 p Transl. into ENGLISH from selected foreign periodicals (France)
(JPRS-70242) Avail: NTIS HC A03/MF A01

Translations are given of reports from the world press and radio relating to worldwide political, economic and technical developments in telecommunications, computers, and satellite communications. Coverage is worldwide with focus on France, Federal Republic of Germany, United Kingdom, Italy, Japan, the USSR, People's Republic of China, Sweden, and the Netherlands. Author

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N78-13318 Purdue Univ., Lafayette, Ind.
HIGH GRADIENT MAGNETIC SEPARATION: SINGLE WIRE STUDIES Ph.D. Thesis
Carl Claudius Cowen 1976 115 p
Avail: Univ. Microfilms Order No. 77-15394

A large number of ferromagnetic strands packed into a flow chamber with a high magnetic field imposed are the centers of magnetic gradients and the collection points in filters used in the kaolin industry. Photographs and hot-wire anemometry were used to examine the rate and shape of deposition in a single collection wire in the magnetic field until saturation. Three cases were considered: where the magnetic field, the collection wire, and the fluid flow are all mutually perpendicular; where the fluid flow and the magnetic field are parallel and both are perpendicular to the collection wire; where the fluid flow and collection wire are parallel and both are perpendicular to the magnetic field. Dissert. Abstr.

N78-13319 Tennessee Univ., Knoxville.
PRECISION RECTIFIER DETECTORS FOR AC RESISTANCE BRIDGE MEASUREMENTS WITH APPLICATION TO TEMPERATURE CONTROL SYSTEMS FOR IRRADIATION CREEP EXPERIMENTS Ph.D. Thesis
Michael Gary Duncan 1977 349 p
Avail: Univ. Microfilms Order No. 77-16579

The suitability of several temperature measurement schemes for an irradiation creep experiment is examined. It was found that the specimen resistance can be used to measure and control the sample temperature if compensated for resistance drift due to radiation and annealing effects. A modified Kelvin bridge was presented that allows compensation for resistance drift by periodically checking the sample resistance at a controlled ambient temperature. A phase insensitive method for detecting the bridge error signals was studied. The phase insensitive detector is formed by averaging the magnitude of two bridge voltages. Although this method is substantially less sensitive to stray reactances in the bridge than conventional phase sensitive detectors, it is sensitive to gain stability and linearity of the rectifier circuits. Accuracy limitations of rectifier circuits were examined both theoretically and experimentally in great detail. Both hand analyses and computer simulations of rectifier errors were described. Dissert. Abstr.

N78-13320* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
GERMANIUM COATED MICROBRIDGE AND METHOD Patent
Louis B. Holderman and Palmer N. Peters, inventors (to NASA) (NAS-NRC) Issued 25 Oct. 1977 5 p Filed 13 Aug. 1976 Supersedes N76-30084 (14 - 20, p 2670)
(NASA-Case-MFS-23274-1; US-Patent-4,055,847; US-Patent-Appl-SN-714158; US-Patent-Class-357-5; US-Patent-Class-357-4; US-Patent-Class-357-73; US-Patent-Class-307-306; US-Patent-Class-338-32S) Avail: US Patent Office CSCL 09C

A superconducting microbridge is provided for use in superconducting quantum interference devices wherein a pair of spaced layers of superconductive material are connected by a weak link bridge to establish an electrical junction. The superconductive layers and bridge are coated with a semiconductor material shunting the bridge at room temperatures to prevent the destruction of the device by minute electrical currents while the coating acts as a dielectric permitting normal electrical behavior of the microbridge at cryogenic temperatures.
Official Gazette of the U.S. Patent Office

N78-13321 British Library Lending Div., Boston Spa (England).
SUPPLIES TO AUXILIARY EQUIPMENT IN VEHICLES WITH A THREE-PHASE POWER SYSTEM
Werner Teich Jun. 1977 18 p refs Transl. into ENGLISH from Eisenbahn-technische Rundschau (West-Germany), v. 7/8, 1976 p 425-430
(BLL-RTS-10636) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

A three phase power system is examined as a souce of power for auxiliary equipment on electric locomotives. Generator and traction motor cooling, inverse rectifier and brake resistor cooling, train current, and control circuits are among the topics considered. it is concluded that the three phase system offers a cost effective and simple solution to the problem of power supplies for auxiliary equipment in diesel locomotives. J.M.S.

N78-13322 California Inst. of Tech., Pasadena.
MODELING, ANALYSIS, AND DESIGN OF SWITCHING CONVERTERS Ph.D. Thesis
Slobodan M. Cuk 1977 317 p
Avail: Univ. Microfilms Order No. 77-19978

A linear model was obtained for the inherently nonlinear power stage in which dc conversion is accomplished. A general unified approach to modelling and analysis of switching dc-to-dc converters was developed which was directly applicable to any dc-to-dc converter operating in either of two conduction modes, and which resulted in a final dynamic linear model. Part of this analysis technique, called state-space averaging, was applied to the continuous conduction mode of converter operation, while appropriate extension of the method to the discontinuous conduction mode was made. The culmination of the modelling and analysis was achieved in the development of canonical circuit models which represent any such converter regardless of its detailed configuration. Dissert. Abstr.

N78-13323 Minnesota Univ., Minneapolis.
INVESTIGATION OF THE LOCK-LAYER TRANSISTOR STRUCTURE Ph.D. Thesis
Bernard Louis Grung 1976 212 p

Avail: Univ. Microfilms Order No. 77-18992

The characteristics of prototype lock-layer transistors were investigated. For most applications, a lock-layer transistor can be viewed as a merged cascade configuration of two conventional transistors, a bipolar transistor and a junction field effect transistor. For some applications, a lock-layer transistor has unique characteristics. The primary advantage provided by a lock-layer transistor as compared to most other conventional bipolar junction transistors is the combination of high current-gain values with large common emitter breakdown voltage. In the ordinary high gain or super beta transistor, breakdown voltage is drastically degraded. A subsidiary advantage is freedom from the early effect, which causes the conventional transistor to exhibit sloping output characteristics; the lock-layer transistor's output characteristics are almost parallel to the voltage axis. Dissert. Abstr.

N78-13324 Minnesota Univ., Minneapolis.
THE PHYSICAL MECHANISMS OF SPREADING RESISTANCE MEASUREMENTS ON SILICON Ph.D. Thesis
Thomas Ernest Hendrickson 1976 285 p
Avail: Univ. Microfilms Order No. 77-18996

Measurement of the resistance between a circular contact and a semi-infinite resistive material was examined. Energy-gap variations, mobility variations, phase changes, p-n junction effects, and nonuniform doping profiles were among the factors studied. Using a standard surface as a reference, it was concluded that the best representation of the contact was a Schottky diode. It was found that the high pressures encountered during probing produced rupture of the material, large piezoresistive effects, and significant lowering of the energy gap. Dissert. Abstr.

N78-13325*# Maya Development Corp., San Diego, Calif.
THE EFFECT OF ENVIRONMENTAL PLASMA INTERACTIONS ON THE PERFORMANCE OF THE SOLAR SAIL SYSTEM Contractor Report, Jul. 1976 - Jul. 1977
Marvin Douglas, Robert Laquey, and Sherman DeForest Aug. 1977 104 p refs
(Contract NAS3-20119)
(NASA-CR-135258) Avail: NTIS HC A06/MF A01 CSCL 09C

Interaction between the solar sail and the natural plasma environment were examined for deleterious impacts upon the operation of the sail and its associated payload. Electrostatic charging of the sail in the solar wind and in near earth environment were examined. Deployment problems were studied. An analysis of electromechanical oscillations coupling the sail to the natural plasma was performed. As a result of these studies, it was concluded that none of these effects will have a significant negative impact upon the sail operation. The natural environment will be significantly perturbed and this will preclude measurements of electric and magnetic fields from an attached payload. Author

N78-13326*# Hughes Aircraft Co., Culver City, Calif. Advanced Technology Lab.
OPTICAL SCANNING TESTS OF COMPLEX CMOS MICROCIRCUITS Final Report, May 1976 - Apr. 1977
M. E. Levy and J. J. Erickson Oct. 1977 122 p refs
(Contract NAS8-31239)
(NASA-CR-150474; P77-396) Avail: NTIS HC A06/MF A01 CSCL 09C

The new test method was based on the use of a raster-scanned optical stimulus in combination with special electrical test procedures. The raster-scanned optical stimulus was provided by an optical spot scanner, an instrument that combines a scanning optical microscope with electronic instrumentation to process and display the electric photoresponse signal induced in a device that is being tested. Author

N78-13327*# National Aeronautics and Space Administration, Washington, D. C.
FREQUENCY METHOD FOR DETERMINING THE PARAMETERS OF THE ELECTROMAGNETIC BRAKES AND SLIP-TYPE COUPLINGS WITH SOLID MAGNETIC CIRCUITS
F. G. Guseynov and E. M. Abbasova Dec. 1977 18 p refs Transl. into ENGLISH from Elektrichestvo (USSR), no. 1, Jan. 1971 p 44-49 Transl. by Sci. Transl. Serv., Santa Barbara, Calif.
(NASA-TM-75192) Avail: NTIS HC A02/MF A01 CSCL 09C

The equivalent representation of brakes and coupling by lumped circuits is investigated. Analytical equations are derived for relating the indices of the transients to the parameters of the equivalent circuits for arbitrary rotor speed. A computer algorithm is given for the calculations. Author

N78-13328*# Systems Science and Software, La Jolla, Calif.
A THREE DIMENSIONAL DYNAMIC STUDY OF ELECTROSTATIC CHARGING IN MATERIALS Contractor Report, Jul. 1976 - Jul. 1977
I. Katz, D. E. Parks, M. J. Mandell, J. M. Harvey, D. H. Brownell, Jr., S. S. Wang, and M. Rotenberg Aug. 1977 334 p refs (Contract NAS3-20119)
(NASA-CR-135256; SSS-R-77-3367) Avail: NTIS HC A15/MF A01 CSCL 09C

A description is given of the physical models employed in the NASCAP (NASA Charging Analyzer Program) code, and several test cases are presented. NASCAP dynamically simulates the charging of an object made of conducting segments which may be entirely or partially covered with thin dielectric films. The object may be subject to either ground test or space user-specified environments. The simulation alternately treats (1) the tendency of materials to accumulate and emit charge when subject to plasma environment, and (2) the consequent response of the charged particle environment to an object's electrostatic field. Parameterized formulations of the emission properties of materials subject to bombardment by electrons, protons, and sunlight are presented. Values of the parameters are suggested for clean aluminum, Al2O3, clean magnesium, MgO, SiO2 kapton, and teflon. A discussion of conductivity in thin dielectrics subject to radiation and high fields is given, together with a sample calculation. Author

N78-13329*# Systems Science and Software, La Jolla, Calif.
NASCAP USER'S MANUAL Contractor Report, Jul. 1976 - Jul. 1977
M. J. Mandell, J. M. Harvey, and I. Katz Aug. 1977 354 p refs
(Contract NAS3-20119)
(NASA-CR-135259; SSS-R-77-3368) Avail: NTIS HC A16/MF A01 CSCL 09C

The NASCAP (NASA Charging Analyzer Program) code simulates the charging process for a complex object in either tenuous plasma or ground test environment. Detailed specifications needed to run the code are presented. The object definition section, OBJDEF, allows the test object to be easily defined in the cubic mesh. The test object is composed of conducting sections which may be wholly or partially covered with thin dielectric coatings. The potential section, POTENT, obtains the electrostatic potential in the space surrounding the object. It uses the conjugate gradient method to solve the finite element formulation of Poisson's equation. The CHARGE section of NASCAP treats charge redistribution among the surface cells of the object as well as charging through radiation bombardment. NASCAP has facilities for extensive graphical output, including several types of object display plots, potential contour plots, space charge density contour plots, current density plots, and particle trajectory plots. Author

N78-13330*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
POTENTIAL DAMAGE TO DC SUPERCONDUCTING MAGNETS DUE TO THE HIGH FREQUENCY ELECTROMAGNETIC WAVES
G. J. Gabriel (Notre Dame Univ.) 1977 10 p refs Presented at 7th Symp. on Engineering Problems of Fusion Res., Knoxville, Tenn., 25-28 Oct. 1977; sponsored by IEEE.
(NASA-TM-73808) Avail: NTIS HC A02/MF A01 CSCL 09C

Experimental data are presented in support of the hypothesis that a dc superconducting magnet coil does not behave strictly as an inductor, but as a complicated electrodynamic device capable of supporting electromagnetic waves. Travel times of nanosecond pulses and evidence of sinusoidal standing waves were observed on a prototype four-layer solenoidal coil at room temperature. Ringing observed during switching transients appears as a sequence of multiple reflected square pulses whose durations are related to the layer lengths. With sinusoidal excitation of the coil, the voltage amplitude between a pair of points on the

coil exhibits maxima at those frequencies such that the distance between these points is an odd multiple of half wavelength in free space. Evidence indicates that any disturbance, such as that resulting from switching or sudden fault, initiates multiple reflections between layers, thus raising the possibility for sufficiently high voltages to cause breakdown. Author

N78-13331*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A SUSTAINED-ARC IGNITION SYSTEM FOR INTERNAL COMBUSTION ENGINES
Arthur G. Birchenough Nov. 1977 15 p refs
(NASA-TM-73833; E-9420) Avail: NTIS HC A02/MF A01 CSCL 09C

A sustained-arc ignition system was developed for internal combustion engines. It produces a very-long-duration ignition pulse with an energy in the order of 100 millijoules. The ignition pulse waveform can be controlled to predetermined actual ignition requirements. The design of the sustained-arc ignition system is presented in the report. Author

N78-13332# Harry Diamond Labs., Adelphi, Md.
THIN FILM HYBRID MICROCIRCUITRY. PART 2, MODULATOR CIRCUIT FOR AN EXPERIMENTAL FUZE
Adolphe J. Edwards and Emma L. Hebb Sep. 1977 22 p refs
(DA Proj. 1L6-62616-AH-77)
(AD-A045047; HDL-tm-77-24) Avail: NTIS HC A02/MF A01 CSCL 09/5

This work consisted of the development of a thin film hybrid version of a specialized modulator circuit that had some very stringent requirements. The scheme that was followed used tracings of the outlines of resistors and conductors; also, templates were used to represent add-on devices to permit easy trial of a number of alternative layouts. Computerized thermal analyses were used to determine steady-state component temperatures before adopting the final circuit design. Standard thin-film processing methods were used to fabricate and package the circuits. A number of materials were tried in attempts to encapsulate the circuits for protection during temperature cycling. An encapsulating procedure using flexibilized epoxies was developed that eliminated circuit failures that appeared to be caused by encapsulation stresses. Further work needs to be done on circuit failures at elevated temperatures that are thought to be caused by corrosion or degradation of the aluminum metallization on silicon chip devices. Author (GRA)

N78-13333# RCA Solid State Technology Center, Somerville, N. J.
HIGH-RELIABILITY, LOW-COST INTEGRATED CIRCUITS Quarterly Development Report, 3 May - 3 Aug. 1977
3 Aug. 1977 28 p
(Contract N00039-76-C-0240)
(AD-A045089; QR-6) Avail: NTIS HC A03/MF A01 CSCL 09/5

Wafer fabrication is proceeding as scheduled. The technology development for platimum sputter etching using gold as the etch mask has progressed sufficiently to allow conversion of the COS/MOS circuits to sputter etching. Reliability data to date obtained on CA741 devices shows a 0.0044% per 1000 hours failure rate at 120 C at the 60-percent confidence level. Copper migration in epoxy packages at 125 C has not been observed as a failure mode. Salt atmosphere resistance tests to date have produced excellent results. All required life-test sockets for Phase II and some of the sockets for Phase III of the program have been ordered. GRA

N78-13334# Analytical Systems Engineering Corp., Burlington, Mass.
BREAKDOWN OF INSULATORS: LITERATURE SEARCH
George A. Bakalyar Hanscom AFB, Mass. AFGL 11 Aug. 1977 56 p refs
(Contract F19628-77-C-0174)
(AD-A045588; AFGL-TR-77-0173) Avail: NTIS HC A04/MF A01 CSCL 20/3

The irradiation of dielectric coated metal surfaces by incident magnetospheric fluxes generates problems related to the charging, breakdown and discharging of the dielectric insulator. The overall search objective is to locate and organize reference materials that address significant aspects of the problem. The study divides into ten somewhat independent subjects. Emphasis is placed on the readily available literature during the period up to and including 1961. The experimental measurements during this period were conducted under idealized conditions to achieve reproductibility. That is, the breakdown E field is externally generated and surface breakdown and premature breakdown through voids are suppressed. To unify material, certain basic references concerned with solid state, transport and kinetic theory are cited where appropriate. A few references investigating recent breakdown theory are cited and briefly discussed. The bulk of the theoretical breakdown references and all of the experimental references that are cited in this report are for the time period prior to 1961. Author (GRA)

N78-13335# Dikewood Industries, Inc., Albuquerque, N. Mex.
THEORETICAL STUDY OF THE ELECTRICAL CORONA ON A LONG WIRE Final Report
John Lam Kirtland AFB, N. Mex. AFWL Apr. 1977 59 p refs
(Contract F29601-75-C-0120)
(AD-A045858; DC-TN-1225-3; AFWL-TR-76-230) Avail: NTIS HC A04/MF A01 CSCL 20/3

This report contains a theoretical study of the electrical corona on a long wire. The physics of the phenomenon is discussed in detail, and formulated mathematically in terms of coupled nonlinear partial differential equations. A number of boundary-value problems for these equations are solved to predict the corona breakdown field and the d-c corona voltage-current characteristic. The results are in good agreement with experiment. Finally, the d-c corona effect on large signal propagation along a single wire above ground is examined by solving a nonlinear transmission line equation. The purpose of this study is to identify the set of basic corona equations as well as the mathematical nature of the problem. The application of these equations to analyze the corona effect on aircraft long-wire antennas will entail the solution of certain time-dependent problems of considerable mathematical complexity. These latter problems are not covered in the present study, and should form the subject of future investigations. Author (GRA)

N78-13336# Westinghouse Electric Corp., Horseheads, N. Y. Industry and Government Tube Div.
MANUFACTURING METHODS AND ENGINEERING FOR TFT ADDRESSED DISPLAY Quarterly Report, 7 Feb. - 7 May 1977
D. H. Davies, W. L. Rogers, F. C. Luo, S. D. Burkholder, and M. Green 10 Jul. 1977 52 p refs
(Contract DAAB07-76-C-0027)
(AD-A045492; Rept-77-8F9-PRODE-R3; QR-4) Avail: NTIS HC A04/MF A01 CSCL 09/5

This is the Fourth Quarterly Report on Contract DAAB07-76-C-0027; manufacturing methods and technology evaluation for the fabrication of thin film transistor based solid state displays. A significant reason has been uncovered for the difference in quality between displays fabricated on the laboratory X-Y units and the pilot line. This factor relates to mask contamination and transfer of the contaminants to the glass; the result is an increase in electrical shorts. A partial solution was implemented and a consequent improvement in display quality immediately evident although further advances are still required. Several more rigorous solutions are now being tested. The overall pilot line operational reliability improved with the introduction of modified procedures; the major residual problems are circuit openings and microcracked insulators both of which are thought at this time to be relatively minor. Author (GRA)

N78-13337# Army Electronics Command, Fort Monmouth, N. J. Electronics Technology and Devices Lab.
MILLIMETER FERRITE PHASE SHIFTERS USING ARC PLASMA SPRAY FABRICATION TECHNIQUES Research and Development Technical Report, Oct. 1976 - May 1977
Richard W. Babbitt and Richard A. Stern Jul. 1977 20 p
(DA Proj. 1L7-62705-AH-94)
(AD-A045520; ECOM-4511) Avail: NTIS HC A02/MF A01 CSCL 09/5

Arc plasma spray techniques have previously been developed

for fabricating low microwave frequency non-reciprocal ferrite phase shifters, 3 GHz to 6 GHz. Currently, spraying techniques are being developed for the arc plasma fabrication of ferrite phasers for millimeter frequencies 35 GHz to 95 GHz. It is expected that the arc plasma process will have a significant impact on the cost of millimeter phasors, since they are difficult and expensive to fabricate by conventional techniques. Also, arc plasma millimeter phasors are expected to produce an improved device performance. However, for the arc plasma process to be suitable for fabricating millimeter phasors, new techniques and modifications of arc plasma spraying procedures were required. This report presents the techniques developed and the device performance of arc plasma fabrication 35 GHz non-reciprocal ferrite phasors. Projected costs and future fabrication concepts are also presented. Author (GRA)

N78-13338# RCA Labs., Princeton, N. J.
A LOGIC MODULE USING TRANSFERRED-ELECTRON LOGIC DEVICES FOR PRECISION TIME INTERVAL MEASUREMENTS Final Report, 26 Feb. 1975 - 30 Jun. 1977
W. R. Curtice Sep. 1977 73 p refs
(Contract N00039-75-C-0225)
(AD-A045819; PRRL-77-CR-31) Avail: NTIS HC A04/MF A01 CSCL 09/5

The results of a program to develop a logic module using transferred electron logic devices (TELDs) for use in a short baseline time-difference-of-arrival (TDOA) direction finding system are described. The function of the logic module is to perform high precision, single-event time interval measurements. The ultimate goal for precision is 20 ps. The purpose of the present program is to prove feasibility of time measurement with subnanosecond resolution in a breadboard TELD module. The two input threshold gates and the coincidence circuit utilize TELDs and the pulse burst generators are constructed with GaAs MESFETs. Step recovery diodes have been used for pulse shaping at several points in the circuit. The counters are commercially available and of ECL type. A thorough study was made of the circuit design of the module's components and the results are contained herein. A breadboard system was designed, constructed, and tested without the ECL counters. Four pulses were used for each pulse burst generator and Tc approx 1.2 ns. This produced a resolution of about 400 ps which was confirmed in the tests. In these tests the output of the coincidence circuit was observed as the time delay of the RF signal (0.8 GHz) to one channel was varied. The range of measurement (with counters) is about 2 ns, which is adequate for the present application. GRA

N78-13339# RCA Labs., Princeton, N. J. Process and Applied Materials Research Lab.
BASIC ADHESION MECHANISMS IN THICK AND THIN FILMS Final Report, 1 Jan. - 31 Dec. 1976
Kenneth R. Bube and Thomas T. Hitch Jan. 1977 116 p refs
(Contract N00019-76-C-0256)
(AD-A045831; PRRL-77-CR-2) Avail: NTIS HC A06/MF A01 CSCL 09/5

In this third year of the study, multicomponent systems (consisting of gold plus one or two platinum group metals) were examined in both model and commercial ink form, in order to understand the parameters which affect film adhesion and solderability. Solderable Au-Pt and Au-Pt-Pd metallizations are the second most widely used films in military hybrid circuits. Therefore, the factors which broadly influence metallization solderability, adhesion strength, and aged film adhesion strength, in the presence and absence of solders, were examined in some detail. Of 21 commercially available Au-Pt and Au-Pt-Pd films initially analyzed for composition, and adhesion strength (aged and unaged), five of these and a related ink were selected for more detailed study. Adhesion strength of the six inks was evaluated as a function of three print thicknesses, four peak firing temperatures, and two cooling rates from peak firing temperature. Data are presented for the inks fired on both 96 and 99.5 wt pct alumina substrates. Values for adhesion strength were also determined after aging, both with and without 62Sn-36Pb-2Ag solder present. With one exception, the adhesion strength of the inks was generally sensitive to peak firing temperature and less sensitive to thickness. Cooling rate changes did not affect solderability significantly in any of the six film materials. GRA

N78-13340# Science Applications, Inc., McLean, Va. Manufacturing Technology Project Office.
THE NAVY MANUFACTURING TECHNOLOGY ELECTRONICS STUDY. A PLAN FOR COST EFFECTIVE ELECTRONICS IN THE NAVY. VOLUME 1: STUDY SYNOPSIS Final Report, 1 Dec. 1976 - 30 Jun. 1977
T. M. Knasel and J. T. McGahan 30 Jun. 1977 38 p 3 Vol.
(Contract N00039-77-C-0095)
(AD-A045162; SAI-MT-2010-Vol-1; SAI-78-524-WA-Vol-1)
Avail: NTIS HC A03/MF A01 CSCL 13/8

This study examined investment opportunities in Manufacturing Technology (MT) related to electronic systems procurement and presents an initial candidate plan for the FY80 to 84 timeframe. The major cost areas for electronic products were determined by a top down study of the detailed breakout of electronics subcomponent and labor categories. Results indicate that about half of electronics costs are found in seven key material areas. The remainder of the cost is apportioned into 4 labor areas. The breakout into 11 final categories is based on data for nearly 100 systems. These systems represent a broad spectrum of Navy electronics procurement. The 11 cost categories are cables and cabinets, sensors and special tubes, integrated circuits, small hardware and printed circuit boards (without components attached), discrete semiconductors, hybrid circuits, passive components, assembly labor, fabrication labor, support labor, and test labor. These data are used to estimate net direct savings from MT projects, where applicable opportunities for indirect cost savings are indicated also. To determine project impact and program balance specific cost data were obtained on weapon systems procurement by visiting 58 Navy and industrial offices. Of the fifteen firms visited 90 percent provided data in at least one area. During the review of these data, an additional way was found to look at costs by reviewing the generic processes involved in manufacture. GRA

N78-13341# Science Applications, Inc., McLean, Va. Manufacturing Technology Project Office.
THE NAVY MANUFACTURING TECHNOLOGY ELECTRONICS STUDY. A PLAN FOR COST EFFECTIVE ELECTRONICS IN THE NAVY. VOLUME 2: A CANDIDATE ELECTRONICS MANUFACTURING TECHNOLOGY PLAN Final Report
30 Jun. 1977 137 p 3 Vol.
(Contract N00039-77-C-0095)
(AD-A045163; SAI-MT-2010-Vol-2; SAI-78-524-WA-Vol-2)
Avail: NTIS HC A07/MF A01 CSCL 13/8

This volume contains a candidate manufacturing technology (MT) plan for Navy electronics formulated as a result of the study described briefly in Volume I and in detail in Volume III of this report. The purpose of this volume is to give information on the aspects of the program such as: (1) savings minus investment, (2) savings to investment ratio, (3) timeframe, (4) applicable weapons systems, and (5) manufacturing cost category of cost savings on an overall, as well as individual, project basis. GRA

N78-13342# Science Applications, Inc., McLean, Va. Manufacturing Technology Project Office.
THE NAVY MANUFACTURING TECHNOLOGY ELECTRONICS STUDY. A PLAN FOR COST EFFECTIVE ELECTRONICS IN THE NAVY. VOLUME 3: APPENDICES Final Report
30 Jun. 1971 258 p refs 3 Vol.
(Contract N00039-77-C-0095)
(AD-A045164; SAI-MT-2010-Vol-3; SAI-78-524-WA-Vol-3)
Avail: NTIS HC A12/MF A01 CSCL 13/8

Contents: Electronics MT Project Descriptions; MT Incentives for Industry; Industrial Interview Objectives and Procedures; Army ECOM Conference -Specific Findings; Top-Down Analysis of Navy Weapons Systems Electronics Costs; Economic Analysis and Computer Program Description; Equipment List and Study Results Related to Specific Findings; Bibliography. GRA

N78-13343# Rome Air Development Center, Griffiss AFB, N.Y.
DESIGN OF PARABOLIC CYLINDER REFLECTOR SYSTEMS WITH LOW SIDELOBES

Ronald L. Fante Jun. 1977 38 p refs
(AD-A045619; RADC-TR-77-204) Avail: NTIS HC A03/MF A01 CSCL 09/1

We have determined and synthesized the feed distribution which must be used to illuminate an Offset Parabolic Cylinder in order to obtain a secondary radiation pattern with -50 db sidelobes. Author (GRA)

N78-13344# Advanced Metals Research Corp., Bedford, Mass.
ELECTRONIC BEAM FABRICATION OF SURFACE ACOUSTIC WAVE TRANSDUCERS Final Technical Report, 30 Apr. - 30 Oct. 1976
John A. Doherty Griffiss AFB, N. Y. RADC May 1977 110 p refs
(Contract F19628-76-C-0179)
(AD-A045592; RADC-TR-77-164) Avail: NTIS HC A06/MF A01 CSCL 09/1

A Lanthanum Hexaboride Gun was added to the electron beam fabrication system. Systems programming was advanced. The elements of a cooperative exposure effects model were developed and instituted in the programming. Exposure techniques were developed to optimize resolution and edge definition. Author (GRA)

N78-13345# Edgerton, Germeshausen and Grier, Inc., Salem, Mass.
REPETITIVE SERIES INTERRUPTER 2 Triannual Report No. 4, 1 Mar. - 31 May 1977
Robert Simon and David V. Turnquist Jul. 1977 50 p refs
(Contract DAAB07-76-C-1301; DA Proj. 1L7-62705-AH-94)
(AD-A045628; ECOM-76-1301-4) Avail: NTIS HC A03/MF A01 CSCL 09/5

Further development of the Repetitive Series Interrupter, a hydrogen thyratron modified for opening-switch operation, is described. Deuterium is rejected as an alternative fill gas because of increased interrupting magnetic field requirements due to the greater inertial resistance of the heavier positive ions to the magnetic field-induced transverse diffusion. Modified magnetic field pulse shapes are explored, and an analysis of a positive column of weakly ionized hydrogen gas in a transverse magnetic field is presented. Author (GRA)

N78-13346# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
EVALUATION OF GALLIUM NITRIDE FOR ACTIVE MICROWAVE DEVICES Annual Report, Mar. 1976 - Aug. 1977
M. Gershenzon Aug. 1977 35 p
(Contract N00014-75-C-0295; RR0210203)
(AD-A045419) Avail: NTIS HC A03/MF A01 CSCL 09/5

In an attempt to minimize the high native donor density and the structural defects which lead to high field breakdown, so that high field drift velocity measurements can be made, a high pressure (10,000 atm) high temperature (1500 C) system is being set up to grow, anneal and diffuse GaN under equilibrium N2 pressures, rather than by the nonequilibrium NH3 vapor phase method currently used to prepare GaN. The system should be completely operational within 4 months. A second chemical vapor deposition apparatus designed to grow 50 micrometers crystals on R-plane sapphire at 1050 C is now working and uniform crystals are being grown routinely. Due to non-planar nucleation and growth, these crystals exhibit decorated low angle grain boundaries, some of which crack by differential thermal contraction during cool-down, and stacking faults and random small-scale precipitation in regions paralleling the linear surface topology. Light scattering from these regions colors the bulk samples. Slow growth rates eliminate the precipitated regions and tend to reduce the number of low angle boundaries and associated cracks. However, planar growth, which proceeds very slowly on (1010) sapphire or on self-nucleated whiskers eliminated virtually all these defects. GRA

N78-13347# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
PARAMETER INDEPENDENT DESIGN UTILIZING SCATTERING PARAMETERS M.S. Thesis
William F. Duke Jun. 1977 109 p refs
(AD-A045460; AFIT-GE/EE/77-5) Avail: NTIS HC A06/MF A01 CSCL 09/5

A parameter independence factor for two-part networks is defined and a method for its calculation using finite differences is shown. An approach to two-part scattering-parameter circuit design using computer optimization techniques is developed and illustrations are presented to demonstrate the utilization of a digital computer for implementing this approach. The versatility of the approach is clarified by demonstrating how both standard network design criteria and parameter independent network design requirements are specified and met. This design technique has direct Air Force application in the areas of microwave network design and Electronic Warfare with particular emphasis on the independence of the network parameters with respect to device parameters. Author (GRA)

N78-13348# Maxwell Labs., Inc., San Diego, Calif.
HIGH POWER SPARK GAP OPTIMIZATION Final Report 16 Jun. 1977 55 p
(Contract N60921-76-C-0274)
(AD-A045814; MLR-670) Avail: NTIS HC A04/MF A01 CSCL 09/1

This report completes the High Power Spark Gap Optimization program, which was begun under a previous contract with Wright-Patterson AFB. In that program, data was obtained in the power range of 1-5 MW to investigate switch performance at rep-rates up to 500 pps, and at voltages up to 60 kV. In the current program, the main experimental objectives were to demonstrate spark gap power above 5 MW per switch, and raise operating voltage into the 100 kV range. GRA

N78-13349# Radio Corp. of America, Lancaster, Pa. SSD-Electro-Optics and Devices.
MANUFACTURING METHODS AND TECHNOLOGY (MM AND T) MEASURE FOR FABRICATION OF SILICON TRANSCALENT THYRISTOR Quarterly Report, 1 Apr. - 30 Jun. 1977
R. M. Hopkins, S. W. Kessler, R. E. Reed, and D. R. Trout Aug. 1977 82 p ref
(Contract DAAB07-76-C-8120)
(AD-A045605; QR-3) Avail: NTIS HC A05/MF A01 CSCL 09/1

This Third Quarterly Report describes the progress on the MM and TE program for Transcalent (Heat-Pipe cooled) thyristors. Production engineering measures for the device and the pertinent state-of-the-art on the engineering sample devices is included. Actual test results on the engineering sample devices are listed. The present status includes the completion of the engineering sample device fabrication with the extensive testing sequence nearing completion. Plans for the next Quarter include completion of the engineering sample devices, electrical, mechanical, thermal and environmental testing; selection of the five samples for shipment to the Government and preparation of the Test Report for these engineering samples, as well as the initiation of the material and parts procurements for the Confirmatory sample phase. Author (GRA)

N78-13350# Hughes Research Labs., Malibu, Calif.
SHORT CHANNEL MOS FOR CCD READOUT CIRCUIT Annual Report, Mar. 1976 - Aug. 1977
R. C. Henderson and G. Nash 5 Oct. 1977 62 p refs
(Contract N00173-76-C-0144)
(AD-A045669) Avail: NTIS HC A04/MF A01 CSCL 09/5

Wafer processing techniques have been developed to allow fabricating an n-MOS clamp-sample-and-hold (CSH) circuit suitable for detecting outputs from charge couple device shift registers operating at 25 MHz. The techniques developed include methods to define circa 1 micrometers device features using electron beam lithography as well as the methods of wafer processing to make functional MOSFET devices at these dimensions. In addition, the CSH circuit was designed and thoroughly simulated with computer models. The development work required determining techniques to etch fine structures in thin films of silicon nitride and polycrystalline silicon. Data were also obtained of the amount of underoxidation when a silicon wafer is oxidized using silicon nitride masking features. Methods were also developed to provide 400 A gate oxides, shallow n(+)p junctions, and reliable contacts to these junctions without metallization spiking. Several diagnostic chips were designed and

fabricated. Experience with these provided a list of design rules for the fabrication, in general, of circuits using the high resolution nitride masked oxidation process. It also provided a list of device performance parameters. Author (GRA)

N78-13351# Stanford Univ., Calif. Digital Systems Lab.
SPRINT: AN INTERACTIVE SYSTEM FOR PRINTED CIRCUIT BOARD DESIGN USERS GUIDE
W. M. VanCleemput, T. C. Bennett, J. A. Hupp, and K. R. Stevens Jun. 1977 141 p
(Contracts N00014-75-C-0601; E4-76-C-03-0515)
(AD-A045653; DSL-TR-143) Avail: NTIS HC A07/MF A01 CSCL 09/5

The SPRINT system for the design of printed circuit boards is a collection of programs that allows designers to interactively design two-sided boards using a Tektronix 4013 graphics terminal. The major parts of the system are: a compiler for SDL, the Structural Design Language, and interactive component placement program, an interactive manual conductor routing program, and automatic batch router, a via elimination program and a set of artwork generation programs. Author (GRA)

N78-13352# Sandia Labs., Albuquerque, N. Mex. Antenna Development Div.
CIRCULAR MICROSTRIP ANTENNAS
George H. Schnetzer Apr. 1977 46 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0376) Avail: NTIS HC A03/MF A01

The circular microstrip antenna was analyzed by developing the field equations within the antenna in terms of Bessel functions. When the order of the Bessel functions is 1, the antenna radiates normal to the surface on which the antenna is mounted. Equations were developed for calculation of radiation patterns, impedance, bandwidth and efficiency when the antenna is operating in this mode. Curves were provided to assist in the design of a circular microstrip antenna. ERA

N78-13353# Thomson-CSF, Boulogne-Billancourt (France). Div. Tubes Electroniques.
TECHNOLOGICAL PROBLEMS ASSOCIATED WITH THE CONCEPT OF A CHARGE TRANSFER DEVICE Final Report [ETUDE DES PROBLEMES TECHNOLOGIQUES ASSOCIES AU CONCEPT D'UN DISPOSITIF A TRANSFERT DE CHARGES]
Blamoutier and Veron Paris ESA 12 May 1977 88 p refs In FRENCH
(Contract ESTEC-2865/76)
(TDI/1.1435/77; RT-1833-T; ESA-CR(P)-973) Avail: NTIS HC A05/MF A01

Studies on identification and analysis of technological problems in the realization of a charge transfer image intensifier tube are described. This device is to be utilized as a sensor in the faint object camera of the LST. Different types of electronic image transport are surveyed. The overall characteristics of the structure and operation of a CCD matrix for this type of application are examined. Two versions of image transfer are described: electrostatic and electromagnetic focusing, including CCD matrices working in parallel or series transfer mode. The major technological problems to be resolved are outlined for the overall CCD intensifier, and solutions proposed. Performances for different operating modes are evaluated. ESA

N78-13354# Technische Hochschule, Darmstadt (West Germany). Fachgebiet Uebertragungstechnik.
DESIGN OF LINEAR NETWORKS WITH PRESCRIBED IMPULSE RESPONSE
Hermann Kremer Jun. 1977 15 p refs
(IND-FB-100) Avail: NTIS HC A02/MF A01

The method presented uses Prony's algorithm for the approximation and gives the network as a parallel structure of, at most, second order subnetworks. The algorithm and some numerical and computational aspects are described briefly. The method is illustrated by two examples, the design of a Hilbert filter and an ideal low-pass filter. Author (ESA)

N78-13355# Electricity Council Research Center, Capenhurst (England).
CYCLIC VOLTAMMETRY STUDIES ON PURE LEAD
J. G. Sunderland Aug. 1976 9 p refs
(ECRC/N974) Avail: NTIS HC A02/MF A01

The behavior of pure lead in sulfuric acid was studied by cyclic voltammetry. The appearance of an anodic current peak on the cathodic portion of the sweep, previously attributed to a phase change in the lead dioxide film, is re-interpreted in the light of this work as being due to the oxidation of water by an intermediate lead III species. Author (ESA)

N78-13356# Electricity Council Research Center, Capenhurst (England).
THE INFLUENCE OF WATER ON THE ELECTRIC STRENGTH OF AN ETHYLENE-PROPYLENE MONOMER INSULATION
R. D. Naybour Aug. 1977 11 p refs
(ECRC/N1073) Avail: NTIS HC A02/MF A01

Needle tests on samples of ethylene propylene monomer based insulation after water absorption confirmed that the short term life at voltage is extended by the presence of water. Also, it is shown that water is desorbed more rapidly than absorbed and this is accompanied by a reduction in electric strength. This result implies that tests on cables after water immersion should involve a short drying period to ensure any deterioration is detected. Author (ESA)

N78-13357# Battelle Pacific Northwest Labs., Richland, Wash.
ALTERNATIVE ELECTRICAL TRANSMISSION SYSTEMS AND THEIR ENVIRONMENTAL IMPACT
G. F. Schiefelbein Aug. 1977 208 p refs
(Contract EY-76-C-06-1830)
(PB-271652/0; NUREG-0316) Avail: NTIS HC A10/MF A01 CSCL 09C

A general description of electrical transmission systems as an aid to the NRC in determining their environmental impacts is provided. Alternating current and direct current overhead and underground systems and their potential impacts were treated in sufficient detail. GRA

N78-13358# RCA Labs., Princeton, N. J.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: A 25kV BIAS-ISOLATION UNIT FOR 1-MHz CAPACITANCE AND CONDUCTANCE MEASUREMENTS
Alvin M. Goodman Sep. 1977 61 p refs
(Contract NBS-5-35912; ARPA Order 2397)
(PB-271522/5; NBS-SP-400-40; LC-77-608178) Avail: NTIS HC A04/MF A01 CSCL 14B

A technique for using a commercially available C/G-meter with a Bias-Isolation Unit (BIU) for C and G measurements at bias voltage magnitudes up to 25 kV without damage to the measurement equipment is described. The basic principles of operation and the details of the electrical design of a BIU were presented. The use of the BIU imposes certain limitations on the range of sample capacitance and conductance that may be measured without introducing excessive error. The theory of these limitations is presented and compared with experimental results obtained from the use of the BIU. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N78-13359 Iowa State Univ. of Science and Technology, Ames.
TURBULENT MIXING WITH CHEMICAL REACTION AND COLLECTION OF INERTIALESS PARTICLES ON CYLINDERS AND SPHEROIDS WITH ELECTRICAL FORCES AND GRAVITATION Ph.D. Thesis
Kenneth Andrew Nielsen 1977 559 p
Avail: Univ. Microfilms Order No. 77-16969

By numerically integrating the Fourier transformed exact conservation equations of reactants over time using a numerical simulation of a homogeneous isotropic turbulent velocity field for the convection velocity, O'Brien's and Toor's statistical

independence hypotheses were tested. Two simulated turbulent velocity fields that obey continuity were used. The first had a constant specified energy spectrum but lacked interaction between Fourier modes. The second velocity field, which was generated using a modified form of the Navier-Stokes equation, had interaction and conserved energy but the energy-spectrum was transient. Dissert. Abstr.

N78-13360 California Univ., Los Angeles.
FINITE DIFFERENCE SOLUTION OF RECIRCULATING FLOW IN A TWO-DIMENSIONAL CAVITY AT HIGH REYNOLDS NUMBER Ph.D. Thesis
Allan Sherman Benjamin 1977 208 p
Avail: Univ. Microfilms Order No. 77-16148

Convergence properties of various finite difference schemes for solving the equations of motion for recirculating, steadystate flow of an incompressible fluid in a square, two dimensional cavity are examined at Reynolds numbers up to 10 to the 4th power. The effects of grid conserving coordinate transformations, spatially nonuniform ADI relaxation parameters, cell Reynolds number, and order correct treatments of the vorticity boundary condition on such issues as accuracy and rate of convergence were established. Formulation of the advection term in convective, divergence, and Arakawa-conservative forms was discussed in terms of global conservation of vorticity, kinetic energy, and square vorticity. The use of linearization of nonlinear terms and upwind versus central differencing was examined, both by numerical experimentation and by analytical treatment of stability.
Dissert. Abstr.

N78-13361*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ON THE LOCALNESS OF THE SPECTRAL ENERGY TRANSFER IN TURBULENCE
R. G. Deissler 1977 20 p refs Presented at 13th Anniv. Meeting of the Fluid Mec. Div. of the Amer. Phys. Soc., Bethlehem, Penn., 21-23 Nov. 1977
(NASA-TM-73824; E-9376) Avail: NTIS HC A02/MF A01 CSCL 20D

By utilizing available experimental data for net energy transfer spectra for homogeneous turbulence, contributions P(k,k prime 1) to the energy transfer at a wavenumber k from various other wavenumbers k prime 1 are calculated. This is done by fitting a truncated power - exponential series in k and k prime 1 to the experimental data for the net energy transfer T(k), and using known properties of P(k,k prime 1). Although the contributions P(k,k prime 1) obtained by using this procedure are not unique, the results obtained by using various assumptions do not differ significantly. It seems clear from the results that for a region where the energy entering a wavenumber band dominates that leaving, much of the energy entering the band comes from wavenumbers which are about an order of magnitude smaller. That is, the energy transfer is rather nonlocal. This result is not significantly dependent on Reynolds number. For lower wavenumbers, where more energy leaves than enters a wavenumber band, the energy transfer into the band is more local, but much of the energy then leaves at distant wavenumbers. Author

N78-13362 Rice Univ., Houston, Tex.
HYDRODYNAMIC STABILITY OF VISCOELASTIC FLUIDS IN EXTRUSION Ph.D. Thesis
Leidulf Magnar Skorge 1977 305 p
Avail: Univ. Microfilms Order No. 77-19271

Linear hydrodynamic stability theory was applied to predict the instability conditions for isothermal, viscoelastic fluids in extrusion. The draw-down and the metering sections were analyzed. The Bird-Carreau integral constitutive model was applied. The steady state flow in the draw-down section was considered uniformly elongational and in the metering section pure Poiseuille flow upon which an elongational component was superimposed. Only small extension rates could be considered on account of compatibility. A three dimensional, axisymmetrical velocity perturbation field was considered. It was shown that three dimensional disturbances are never more unstable than one or two dimensional disturbances. Dissert. Abstr.

N78-13363 Pennsylvania Univ., Philadelphia.
STATISTICAL THERMODYNAMICS OF TWO-DIMENSIONAL AND ADSORBED FLUIDS Ph.D. Thesis
Eduardo Daniel Glandt 1977 256 p
Avail: Univ. Microfilms Order No. 77-19851

In reference to matter constrained to only two dimensions, calculations of structure, thermodynamic properties and applications of two dimensional layers of a fluid-like nature were investigated. A two dimensional gas phase was considered and the application of some relevant liquid theories to the two dimensional case was considered. A quasi-thermodynamic investigation was accomplished of the liquid-solid equilibrium in two dimensions. The application of two dimensional liquid theories to the description of monolayers of rare gases adsorbed on the basal plane of graphite was studied as well. Dissert. Abstr.

N78-13364*# Ohio State Univ. Research Foundation, Columbus.
STUDIES OF HEAT-SOURCE DRIVEN NATURAL CONVECTION: A NUMERICAL INVESTIGATION Final Report, 1 Jul. 1975 - 30 Jun. 1977
A. A. Emara and F. A. Kulacki Aug. 1977 61 p refs
(Grant NGR-36-008-205; RF Proj. 3746)
(NASA-CR-155322) Avail: NTIS HC A04/MF A01 CSCL 20D

Thermal convection driven by uniform volumetric energy sources was studied in a horizontal fluid layer bounded from above by a rigid, isothermal surface and from below by a rigid, zero heat-flux surface. The side walls of the fluid domain were assumed to be rigid and perfectly insulating. The computations were formally restricted to two-dimensional laminar convection but were carried out for a range of Rayleigh numbers which spans the regimes of laminar and turbulent flow. The results of the computations consists of streamline and isotherm patterns, horizontally averaged temperature distributions, and horizontally averaged Nusselt numbers at the upper surface. Flow and temperature fields do not exhibit a steady state, but horizontally averaged Nusselt numbers reach limiting, quasi-steady values for all Rayleigh numbers considered. Correlations of the Nusselt number in terms of the Rayleigh and Prandtl numbers were determined. Author

N78-13365*# SECO-DYN, Inc., Pomona, Calif.
WATER IMPACT SHOCK TEST SYSTEM Final Report
10 Nov. 1977 85 p
(Contract NAS8-31945)
(NASA-CR-150473) Avail: NTIS HC A05/MF A01 CSCL 20D

The basic objective was to design, manufacture, and install a shock test system which, in part, would have the ability to subject test articles weighing up to 1,000 pounds to both half sine and/or full sine pulses having peak levels of up to 50 G's with half sine pulse durations of 100 milliseconds or full sine period duration of 200 milliseconds. The tolerances associated with the aforementioned pulses were +20% and -10% for the peak levels and plus or minus 10% for the pulse durations. The subject shock test system was to be capable of accepting test article sizes of up to 4 feet by 4 feet mounting surface by 4 feet in length. Author

N78-13366*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A SOLUTION TO THE NAVIER-STOKES EQUATIONS BASED UPON THE NEWTON KANTOROVICH METHOD
Joseph E. Davis (Davis (Joseph E.)), Ralph E. Gabrielsen, and Unmeel B. Mehta (Stanford Univ., Calif.) Aug. 1977 39 p refs
(NASA-TM-78437; A-7212) Avail: NTIS HC A03/MF A01 CSCL 20D

An implicit finite difference scheme based on the Newton-Kantorovich technique was developed for the numerical solution of the nonsteady, incompressible, two-dimensional Navier-Stokes equations in conservation-law form. The algorithm was second-order-time accurate, noniterative with regard to the nonlinear terms in the vorticity transport equation except at the earliest few time steps, and spatially factored. Numerical results were obtained with the technique for a circular cylinder at Reynolds number 15. Results indicate that the technique is in excellent agreement with other numerical techniques for all geometries and Reynolds numbers investigated, and indicates a potential

for significant reduction in computation time over current iterative techniques. Author

N78-13367*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN ILLIAC PROGRAM FOR THE NUMERICAL SIMULATION OF HOMOGENEOUS INCOMPRESSIBLE TURBULENCE
Robert S. Rogallo Nov. 1977 35 p refs
(NASA-TM-73203; A-6899) Avail: NTIS HC A03/MF A01 CSCL 20D

An algorithm and ILLIAC computer program, developed for the simulation of homogeneous incompressible turbulence in the presence of an applied mean strain, are described. The turbulence field is represented spatially by a truncated triple Fourier series (spectral method) and followed in time using a fourth-order Runge-Kutta algorithm. These include: (1) transformation of variables suggested by Taylor's sudden-distortion theory; (2) implicit viscous diffusion by use of an integrating factor; (3) implicit pressure calculation suggested by Taylor's sudden-distortion theory, and (4) inexpensive control of aliasing by random and phased coordinate shifts. Author

N78-13368*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PARAMETRIC PERFORMANCE OF A SPIRAL-ARTERY, LIQUID-TRAP-DIODE HEAT PIPE
Richard J. Williams Oct. 1977 39 p refs
(NASA-TM-78448; A-7255) Avail: NTIS HC A03/MF A01 CSCL 20D

A series of parametric investigations are described which determine the effect of various fluid charges on the performance of a 0.635-cm-diam spiral-artery, liquid-trap diode in both the forward and reverse modes. Specific parameters such as forward- and reverse-mode conductances, shutdown times and energies, and recovery to forward-model operation, are evaluated for ethane as a working fluid in the temperature range 170 K to 220 K. Results indicate that the heat pipe will not reliably start up in the forward mode. However, startup can be initiated when preceded by a diode reversal. Also included are data which show the susceptibility of the diode to fluid charge and tilt. The optimum fluid charge was found to be 2.67 g and transport capability at this charge was in excess of 1200 W-cm at 200 K. The diode in the reverse mode exhibited a rapid shutdown (within 9 min) with a shutdown energy of 1150 J (0.32 Wh). Author

N78-13369*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF AIRSTREAM VELOCITY ON MEAN DROP DIAMETERS OF WATER SPRAYS PRODUCED BY PRESSURE AND AIR ATOMIZING NOZZLES
Robert D. Ingebo 1977 9 p refs Presented at Winter Ann. Meeting, Atlanta, Ga., 27 Nov. - 2 Dec. 1977
(NASA-TM-73740; E-9304) Avail: NTIS HC A02/MF A01 CSCL 20D

A scanning radiometer was used to determine the effect of airstream velocity on the mean drop diameter of water sprays produced by pressure atomizing and air atomizing fuel nozzles used in previous combustion studies. Increasing airstream velocity from 23 to 53.4 meters per second reduced the Sauter mean diameter by approximately 50 percent with both types of fuel nozzles. The use of a sonic cup attached to the tip of an air assist nozzle reduced the Sauter mean diameter by approximately 40 percent. Test conditions included airstream velocities of 23 to 53.4 meters per second at 293 K and atmospheric pressure. Author

N78-13370*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN EXPERIMENTAL INVESTIGATION OF BOUNDARY LAYER AND CROSSFLOW CHARACTERISTICS OF THE AMES 2 BY 2 FOOT AND 11 BY 11 FOOT TRANSONIC WIND-TUNNEL WALLS
Gerald Matyk and Yasunori Kobayashi 1977 41 p refs
(NASA-TM-73257; A-7098) Avail: NTIS HC A03/MF A01 CSCL 20D

The boundary layer and crossflow characteristics of 2- by 2-foot and 11- by 11-foot transonic wind-tunnel wall configurations have been studied for Mach numbers ranging from 0.5 to 1.2 and for various crossflow to free stream unit mass flow ratios. For the 2- by 2-ft and 11- by 11-ft wall configurations, these ratios ranged from 0 to 0.12 and from 0 to 0.07, respectively. Most notably, for both wall configurations, the pressure-drop coefficient across the wall was nonlinear with mass flow and invariant with Mach number. Author

N78-13371*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CALCULATION METHODS FOR COMPRESSIBLE TURBULENT BOUNDARY LAYERS, 1976
Dennis M. Bushnell, Aubrey M. Cary, Jr., and Julius E. Harris 1977 146 p refs Presented at the 1976 Von Karman Inst. for Fluid Dyn. Lecture Ser. Compressible Turbulent Boundary Layers, Rhode-St.-Genese, Belgium, 1-5 Mar. 1976
(NASA-SP-422) Avail: NTIS HC A07/MF A01 CSCL 20D

Equations and closure methods for compressible turbulent boundary layers are discussed. Flow phenomena peculiar to calculation of these boundary layers were considered, along with calculations of three dimensional compressible turbulent boundary layers. Procedures for ascertaining nonsimilar two and three dimensional compressible turbulent boundary layers were appended, including finite difference, finite element, and mass-weighted residual methods. For individual titles, see N78-13372 through N78-13375.

N78-13372*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EQUATIONS AND CLOSURE METHODS
In its Calculation Methods for Compressible Turbulent Boundary Layers, 1976 1977 p 6-8 (For availability see N78-13371 04-34)
Avail: NTIS HC A07/MF A01 CSCL 20D

Basic differential equations governing compressible turbulent boundary layer flow are reviewed, including conservation of mass and energy, momentum equations derived from Navier-Stokes equations, and equations of state. Closure procedures were broken down into: (1) simple or zeroth-order methods, (2) first-order or mean field closure methods, and (3) second-order or mean turbulence field methods. J.A.M.

N78-13373*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLOW PHENOMENA PECULIAR TO CALCULATION OF COMPRESSIBLE TURBULENT BOUNDARY LAYERS
In its Calculation Methods for Compressible Turbulent Boundary Layers, 1976 1977 p 9-46 (For availability see N78-13371 04-34)
Avail: NTIS HC A07/MF A01 CSCL 20D

Calculation procedures for compressible turbulent boundary layers were based upon techniques, modeling constants, etc., developed originally for the low speed case. Significant differences and new or altered physics which occur in the compressible case were considered, as compared with the low speed situation. Possible pitfalls and sources of inaccuracy in the calculations were indicated. Author

N78-13374*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CALCULATION OF THREE-DIMENSIONAL COMPRESSIBLE TURBULENT BOUNDARY LAYERS
In its Calculation Methods for Compressible Turbulent Boundary Layers, 1976 1977 p 47-68 (For availability see N78-13371 04-34)
Avail: NTIS HC A07/MF A01 CSCL 20D

From comparisons of high speed data with low speed closure procedures using variable mean density, there does not appear to be any appreciable influence of compressibility upon turbulent shear stress modeling in compressible turbulent boundary layers, even for extreme cases such as Mach 14 to 20 with a change in density across the layer of up to a factor of 100. Other evidence of apparent lack of compressibility caused new physics which may alter the shear stress for the compressible boundary layer cases including: (1) fluctuation Mach number was generally less than 1; (2) the shear stress distribution through the boundary layer was not a function of Mach number for zero pressure gradient flows; (3) the hypothesis was valid up to Mach 5 (based on fluctuation data), (4) profile N power was

not a function of Mach number, at least up to Mach 10; and (5) the nondimensional burst period was approximately the same as that for low speed. Author

N78-13375*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUMMARY OF CALCULATION PROCEDURES FOR NONSIMILAR TWO- AND THREE-DIMENSIONAL COMPRESSIBLE TURBULENT BOUNDARY LAYERS (FINITE DIFFERENCE, FINITE ELEMENT AND WEIGHTED RESIDUAL METHODS), APPENDIX
In its Calculation Methods for Compressible Turbulent Boundary Layers, 1976 1977 p 69-78 (For availability see N78-13371 04-34)
Avail: NTIS HC A07/MF A01 CSCL 20D

This numerical prediction summary indicates the wide variety of such procedures which are available. Most procedures have detailed user manuals, and in many cases the codes are available. Many of the special effects treated by various methods (such as nonequilibrium or equilibrium chemistry, transition, roughness etc.) are indicated. Author

N78-13376*# Computational Mechanics Consultants, Knoxville, Tenn.
FINITE ELEMENT ANALYSIS OF AEROACOUSTIC JET-FLAP FLOWS Final Report
A. J. Baker and P. D. Manhardt Washington NASA Dec. 1977 69 p refs
(Contract NAS1-14282)
(NASA-CR-2931; CoMoC-76TR-1.2) Avail: NTIS HC A04/MF A01 CSCL 20D

A computational analysis was performed on the steady, turbulent aerodynamic flowfields associated with a jet-blown flap. For regions devoid of flow separation, a parabolic approximation to the governing time-averaged Navier-Stokes equations was applied. Numerical results are presented for the symmetry plane flow of a slot-nozzle planar jet flap geometry, including prediction of flowfield evolution within the secondary mixing region immediately downstream of the trailing edge. Using a two equation turbulence kinetic energy closure model, rapid generation and decay of large spatial gradients in mean and correlated fluctuating velocity components within the immediate wake region were predicted. Modifications to the turbulent flow structure, as induced by porous surface treatment of the flap, were evaluated. The recirculating flow within a representative discrete slot in the surface was evaluated, using the two dimensional, time-averaged Navier-Stokes equations. Author

N78-13377# Lockheed Missiles and Space Co., Palo Alto, Calif.
INVESTIGATION OF THE HEAT ELIMINATION DURING CONTACT BETWEEN A HEAT LIBERATING ELEMENT AND THE SURFACE OF A SUBLIMING SOLID CRYOGENIC AGENT
B. S. Voroshilov, A. B. Grachev, and V. M. Brodianskii 1977 6 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (USSR), v. 33, no. 2, 1977 p 238-242
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Effective heat transfer from heat liberating elements to subliming cryogenic agents was investigated as a means of extending the temperature range of refrigerator operation. A difficulty arising in the production of such refrigerators is related to a vapor interlayer originating between the heat liberating element and the cryogenic agent which sharply degrades the heat transfer process. A forced contact is therefore necessary, accomplished by constant compression of the heat liberating element to the cryogenic agent. Through experimentation with solid carbon dioxide, it was found that use of forced contact permits a 1 to 2 orders change on either side of the heat flux density within 10 to 1000 W/sq m limits without any essential change in temperature difference, and, therefore, the temperature level of the cryostating. Author

N78-13378# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE INFLUENCE OF FREE CONVECTION ON THE RATE OF AEROSOL PRECIPITATION FROM A LAMINAR GAS FLOW
Ia. M. Vizel 1977 6 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (USSR), v. 33, no. 1, 1977 p 44-49
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Results are presented of experiments and computational estimates which show that stream turbulization under the influence of free convection can intensify the aerosol precipitation on the channel walls from a laminar gas flow. Author

N78-13379*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF FILM INJECTION ANGLE ON TURBINE VANE COOLING
James W. Gauntner Dec. 1977 24 p refs
(NASA-TP-1095; E-9254) Avail: NTIS HC A02/MF A01 CSCL 20D

Film ejection from discrete holes in the suction surface of a turbine vane was studied for hole axes (1) slanted 30 deg to the surface in the streamwise direction and (2) slanted 30 deg to the surface and 45 deg from the streamwise direction toward the hub. The holes were near the throat area in a five-row staggered array with 8-diameter spacing. Mass flux ratios were as high as 1.2. The data were obtained in an annular sector cascade at conditions where both the ratio of the boundary layer momentum thickness-to-hole diameter and the momentum thickness Reynolds number were typical of an advanced turbofan engine at both takeoff and cruise. Wall temperatures were measured downstream of each of the rows of holes. Results of this study are expressed as a comparison of cooling effectiveness between the in-line angle injection and the compound-angle injection as a function of mass flux ratio. These heat transfer results are also compared with the results of a referenced flow visualization study. Also included is a closed-form analytical solution for temperature within the film cooled wall. Author

N78-13380*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THERMAL CONTROL CANISTER Patent Application
Stanford Ollendorf, inventor (to NASA) Filed 21 Nov. 1977 28 p
(NASA-Case-GSC-12253-1; US-Patent-Appl-SN-853677) Avail: NTIS HC A03/MF A01 CSCL 20D

A heat dissipating instrument package of a spacecraft, located in a canister having walls in heat transfer relationship with the package, is maintained at a substantially constant temperature. Fixed conductance heat pipes on the canister walls are connected to variable conductance heat pipes, mounted on a radiator structure separated from the canister walls by a thermal blanket. The effective radiating area of the radiator structure is controlled by the variable conductance heat pipes in response to a comparison of a sensed temperature of the instrument package or the canister wall with a set point value. The comparison controls a heater in a gas reservoir containing a non-condensable gas of the variable conductance heat pipe. A thermal radiation shield for the gas reservoir prevents radiant energy from the exterior environment and thermal energy reflected from the spacecraft from overheating the non-condensable gas. NASA

N78-13381# Naval Postgraduate School, Monterey, Calif.
INVESTIGATION OF HEAT TRANSFER IN STRAIGHT AND CURVED RECTANGULAR DUCTS USING LIQUID CRYSTALS THERMOGRAPHY M.S. Thesis
Mario do Carmo Durao Jun. 1977 78 p refs
(AD-A045131) Avail: NTIS HC A05/MF A01 CSCL 20/15

A rectangular cross section channel with both straight and curved test sections was used to investigate the effect of Taylor-Goertler vortices on the heat transfer from the curved section by comparing the results with those obtained in the straight section. The flow was heated through the Joulean heating of one of the walls which was made of Temsheet. Liquid crystals were applied on the surfaces of both test sections. Experiments were run for several values of the volumetric flow rate corresponding to Reynolds numbers between 258 and 920. The average Nusselt number was calculated for each experiment and plotted as function of the Reynolds and Dean numbers. Three distinct regions of the average Nusselt number were observed in the curved section when compared with the straight section. The presence of Taylor-Goertler vortices in the curved section was

verified from the distribution of the liquid crystal color bands. It was concluded that the overall effect of the vortices whenever they occurred was to improve the heat transfer process from the curved section. Author (GRA)

N78-13382# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
SOME EXACT HYDRODYNAMIC FLOWS WITH FREE SURFACES
Joel C. W. Rogers Apr. 1977 56 p refs
(Contract N00017-72-C-4401)
(AD-A045616; APL/JHU/TG-1307) Avail: NTIS HC A04/MF A01 CSCL 20/4

Some exact solutions for the time-dependent incompressible irrotational flow of a fluid contained between two free surfaces are presented. The free surfaces are either concentric circular cylinders or concentric spheres. The cases where constant pressures are applied at one or the other of the free surfaces are also described, and corresponding flows are analyzed for Taylor instability of the free boundaries. When the free boundaries are concentric circular cylinders, flows with constant non-zero circulation for circuits containing the cylinder axis are also described. GRA

N78-13383# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A FINITE ELEMENT METHOD AND CORRESPONDING PILOT COMPUTER CODE FOR HYPERBOLIC SYSTEMS OF EQUATIONS IN TWO SPATIAL DIMENSIONS AND TIME APPLIED TO UNSTEADY GAS FLOWS Final Report
James A. Schmitt Sep. 1977 75 p refs
(AD-A045703; BRL-2017) Avail: NTIS HC A04/MF A01 CSCL 20/4

This report contains a discussion of a numerical method for solving systems of first order time dependent hyperbolic equations in two spatial variables. This scheme which combines the finite element methodology and the properties of a hyperbolic system of differential equations is applied to unsteady gas flow problems. The formulation is based on the elementwise least squares minimization of the differential residual error and on the construction of the finite elements in both space and time. The corresponding computer program is listed. Numerical experiments involving both smooth and shocked flows are discussed. Areas of possible future code development are proposed. Author (GRA)

N78-13384# Ballistic Research Labs., Aberdeen Proving Ground, Md.
AIR SHOCK FILLING OF A MODEL ROOM
V. Kucher and J. Harrison Sep. 1977 109 p
(AD-A044798; BRL-2011) Avail: NTIS HC A06/MF A01 CSCL 19/4

An Eulerian code was used to numerically investigate the air shock filling by a 5-psi overpressure shock wave of a two-dimensional room (4 in. by 4 in.) having a 1-in. centrally located entrance. Numerical results are presented graphically of pressure and velocity fields, vortex motion, and pressure histories at given locations in the room. Comparisons are made with experimental results which were obtained by shadowgraphs and pressure transducers. Author (GRA)

N78-13385# Naval Postgraduate School, Monterey, Calif.
ANALYSIS OF THE WAVE/OBJECT INTERACTION USING DISTRIBUTED SOURCE ELEMENTS OF LINEARLY VARYING STRENGTHS M.S. Thesis
Bruce Arnold Williams Jun. 1977 73 p refs
(AD-A045178) Avail: NTIS HC A04/MF A01 CSCL 08/3

Various computer-oriented numerical schemes are available to evaluate the velocity potentials for inviscid fluid flow past submerged objects. The use of a surface distribution of sources of uniform strength over panels representing the objects surface requires a relatively fine grid to obtain accurate results. A new variation of this scheme using distributed sources of linearly varying strengths over triangular panels appears to reduce the number of panels needed for good results, thereby reducing computer time and storage requirements. In the present study, this technique is applied to the problem of determining fluid forces and dynamic response from interaction between an arbitrarily shaped object and surface waves. Author (GRA)

N78-13386# Pennsylvania State Univ., State College. Applied Research Lab.
A STREAMLINE CURVATURE METHOD OF ANALYZING AXISYMMETRIC AXIAL, MIXED AND RADIAL FLOW TURBOMACHINERY
M. W. McBride 21 Jul. 1977 27 p refs
(Contract N00017-73-C-1418)
(AD-A045122; TM-77-21915) Avail: NTIS HC A03/MF A01 CSCL 20/4

A Streamline Curvature Method of through flow analysis for axisymmetric axial, mixed and radial flow turbomachinery has been implemented. The method can be used for either the direct or indirect problem and can solve open flow problems such as flow through a propeller on a body of revolution as well as the more familiar duct flow problems. Computational refinements allow modeling of blade row chordwise and spanwise loading and blockage distributions and selection of streamline locations. Several examples of the abilities of the analysis are presented. Author (GRA)

N78-13387# Iowa Inst. of Hydraulic Research, Iowa City.
FLOW-VISUALIZATION OF THREE-DIMENSIONAL BOUNDARY-LAYER SEPARATION ON BODIES OF REVOLUTION AT INCIDENCE
Taeyoung Han and V. C. Patel Jun. 1977 78 p refs
(Contract DAAG29-76-G-0036)
(AD-A045245; IIHR-205) Avail: NTIS HC A05/MF A01 CSCL 20/4

Surface streamline patterns on three bodies of revolution, namely a spheroid, a low-drag body and a hemisphere-hemispheroid combination body, have been examined at several angles of attack. Most of the tests were performed at low Reynolds numbers in a hydraulic flume using colored dye to make the surface flow visible. A limited number of experiments were also carried out in a wind tunnel, using wool tufts, to study the influence of Reynolds number and turbulent separation. The study has verified some of the important qualitative features of three-dimensional separation criteria proposed earlier by Maskell, Lighthill, Wang and others. The observed locations of laminar separation lines on a spheroid at various incidences have been compared with the numerical boundary-layer solutions of Wang, and it is suggested that the quantitative differences may be attributed to the significant viscous-inviscid interaction, especially at large incidences. Author (GRA)

N78-13388# ARO, Inc., Arnold Air Force Station, Tenn.
ANALYTICAL DESCRIPTION OF THE COMPLETE TWO-DIMENSIONAL TURBULENT BOUNDARY-LAYER VELOCITY PROFILE Final Report, Oct. 1976 - Mar. 1977
David L. Whitfield AEDC Sep. 1977 43 p refs
(AD-A045033; ARO-PWT-TR-77-43; AEDC-TR-77-79) Avail: NTIS HC A03/MF A01 CSCL 20/4

A single analytical expression is derived for the entire velocity distribution in a two-dimensional, turbulent boundary layer on a smooth impermeable wall. The analytical expression is a linear combination of two trigonometric functions, and the expression depends on the local parameters of skin friction, shape factor, and Reynolds number based on momentum thickness. One of the trigonometric functions is an analytical solution of the continuity, momentum, and turbulent kinetic energy equations in the inner region of the boundary layer and it depends on the inner variable y(+). The other trigonometric function is an empirically derived function for the outer region and it depends on the outer variable y/theta. The analytical result is validated by numerous comparisons with experimental data which include boundary layers near separation, a reattached boundary layer, nonequilibrium boundary layers, and compressible boundary layers. Author (GRA)

N78-13389# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A NOTE ON THE SOLUTION FOR A CIRCULAR GAS JET Final Report
William Walters Sep. 1977 12 p
(AD-A045752; BRL-MR-2787) Avail: NTIS HC A02/MF A01 CSCL 20/4

The classical solution for a circular gas jet given by Schlichting is obtained in exact form. An exact form of the solution is also

presented for a more general form of the governing equations with boundary conditions such that the constants of integration need not be equal to zero. Author (GRA)

N78-13390# National Bureau of Standards, Washington, D. C.
LABORATORY TESTS OF THERMOPLASTIC PIPING ASSEMBLIES SUBJECTED TO WATER HAMMER AND INTERMITTENT HOT WATER FLOW Final Report
Daniel E. Rorrer, James R. Shaver, and Robert S. Wyly Aug. 1977 52 p refs Sponsored by Office of Policy Develop. and Res., Dept. HUD
(PB-270867/5; NBSIR-77-1261) Avail: NTIS HC A04/MF A01 CSCL 13K

Evaluation procedures used for simulating the long-term effects of water hammer (shock pressure) and cycle hot water flow (thermal cycling) on chlorinated polyvinyl (CPVC) thermoplastic pressure piping assemblies are described. Also included are the procedures used to study the effects of thermal cycling of two (2) polyvinyl chloride (PVC) thermoplastic drainage stack assemblies. The shock pressure results show that a fatigue life curve can be established for CPVC as a function of temperature and pressure. As the temperature is decreased the number of shock pressure applications necessary to produce failure increases. GRA

N78-13391# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.
MECHANISMS OF ENERGY TRANSFER IN HYDROGEN FLUORIDE SYSTEMS Interim Report
Roger L. Wilkins 23 Sep. 1977 77 p refs
(Contract F04701-76-C-0077)
(AD-A045617; TR-0077(2603)-5; SAMSO-TR-77-197) Avail: NTIS HC A05/MF A01 CSCL 20/8

Rate coefficients are calculated for the energy-transfer processes that occur when HF(v1,J1) molecules collide with HF(v2,J2) molecules. Three-dimensional classical trajectories of the collision dynamics of these energy-transfer processes were calculated by means of a potential energy surface, which consists of a London-Eyring-Polanyi-Sato (LEPS) potential function for the short-range interactions and a partial-point-charge, dipole-dipole function for the long-range interactions. This energy surface was used to predict an equilibrium geometry of the HF dimer. GRA

N78-13392# Argonne National Lab., Ill.
MULTIDOMAIN MULTIPHASE FLUID MECHANICS
W. T. Sha and S. L. Soo Oct. 1976 131 p refs
(Contract W-31-109-eng-38)
(ANL-CT-77-3) Avail: NTIS HC A07/MF A01

A set of multiphase field equations, conversion of mass, momentum and energy based on multiphase mechanics was developed. The multiphase formulation given takes into account the discreteness of particles of dispersed phases and, at the same time the necessity of aging when handling a large number of particles. Comparisons are made between the field equations formulated based on the multidomain, multiphase fluid mechanics and the pertinent existing models and their relative significances are discussed. The desirability of consistent approximation and simplifications possible for dilute suspensions were examined. ERA

N78-13393# Sandia Labs., Albuquerque, N. Mex. Metallurgy and Electroplating Div.
COMPARATIVE FLOW STABILITY OF MODIFIED SINTERED FLOW CONTROL DEVICES
R. M. German May 1977 27 p refs
(Contract EY-76-C-04-0789)
(SAND-77-8219) Avail: NTIS HC A03/MF A01

Environmental test results are reported for sintered flow control devices. A modified device is described and test results are shown substantiating its improved immunity to environment induced flow reductions. A rationale was outlined describing how the open pore structures in these powder metallurgy parts provide protection for the critical flow paths and thereby improved the stability. ERA

N78-13394# California Univ., Livermore. Lawrence Livermore Lab.
NUMERICAL MODELING OF THE FLUID DYNAMIC STABILITY OF HAGEN-POISEUILLE FLOW Ph.D. Thesis
Demos T. Kyrazis May 1977 196 p refs
(Contract W-7405-eng-48)
(UCRL-52289) Avail: NTIS HC A09/MF A01

The problem of transition from laminar to turbulent flow in a pipe can be understood by examining the stability characteristics of a given time-independent velocity profile when small periodic disturbances are introduced into the flow. A numerical model of Leite's experiment was constructed utilizing the full, nonlinear, time-dependent Navier-Stokes equations. Futhermore, the physical boundary conditions of the experiment were correctly introduced into the numerical model. The validity of the model is demonstrated by showing precise agreement with Leite's experiments. Having reproduced experimental results, the numerical model was then used to further explore the characteristics of the pipe flow. The following new conclusions can be stated as a result of this exploration. For fully developed Hagen-Poiseuille flow a large disturbance is stable and propagates downstream as if it were an infinitesimal disturbance; the time-dependent behavior of the eigen-function is not as would be expected from the stability theory; and for the first time, an unstable solution is shown to exist. ERA

N78-13395# Oak Ridge National Lab., Tenn.
SOME ASPECTS OF INTERPRETING TWO-PHASE FLOW MEASUREMENTS IN INSTRUMENTED PIPING SPOOL PIECES
H. Estrada, Jr. and J. P. Sheppard Apr. 1977 60 p refs Prepared in cooperation with MPR Associates, Inc., Washington, D.C.
(Contract W-7405-eng-26)
(NUREG-0280) Avail: NTIS HC A04/MF A01

Factors affecting the determination of two-phase mass flow rate and quality are discussed utilizing data from instrumented piping spool pieces such as those of the ORNL Thermal Hydraulics Test Facility. Steady state air-water data were correlated with separated flow models which included three different turbine models. Results showed little difference in the use of either the Aya or Rouhani turbine models for quality up to approx. 30%; a model which weighted phase velocities according to void fraction was not representative of the data. A model is presented for the dynamics of a turbine rotor in transient two phase flow. The analysis showed that mechanical inertia of the rotor was less than the inertia of electronic circuitry used to monitor the rotor angular velocity. An analysis is presented of effects of axial separation of instruments on the determination of mass flow. ERA

N78-13396# Sandia Labs., Albuquerque, N. Mex.
STABILITY ANALYSIS OF THE VON NEUMANN-RICHTMYER DIFFERENCE SCHEME WITH RATE DEPENDENT MATERIALS RELATIONS. PART 2: SUBCYCLING AND THE MALVERN RELATION
D. L. Hicks May 1977 31 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0374-Pt-2) Avail: NTIS HC A03/MF A01

Stability criteria are developed for solving problems involving rate-dependent material properties in hydrocodes such as WONDY. As severe restrictions in the allowable timestep size result for small relaxation times, subcycling was introduced to solve this problem. That is, if the subcycle number (m) is large enough, then the timestep restriction as it exists in WONDY is sufficient for stability; this is shown herein for the case of a simple backward difference subcycling scheme for the Malvern rate-dependent material relation. The problem of precisely how large m must be for a given ratio of the timestep to the relaxation time, h = Delta t/tau, was studied. Although the form of solution for m as a function of h is complicated, it can be incorporated easily into WONDY. In the extreme cases of h very small or large, the solution can be simply stated: if h is very small, then m = 1 suffices; if h is greater than 2, then m greater than or equal to h suffices. ERA

N78-13397# This accession not used.

N78-13398# Stuttgart Univ. (West Germany). Energy Conversion and Heat Transfer Div.
LIFETESTS OF THE TELECOMMUNICATIONS SATELLITE HEAT PIPES Final Report
W. D. Muenzel, Principal Investigator Paris ESA Jul. 1977 73 p refs
(Contract ESA-1857/73-JS)
(ESA-CR(P)-997) Avail: NTIS HC A04/MF A01

Test results obtained during lifetests of heat pipes throughout a period of three years are described together with the instrumentation and the test setup. Bendable 7 mm O.D. artery heat pipes have been developed for satellite applications. Four of these heat pipes subjected to a stationary lifetest were operating with a heat load of 15 watts at a temperature of 60 C, and another one, the accelerated lifetest heat pipe, was operated in reflux boiler mode at a temperature of about 100 C. A sixth heat pipe underwent a thermal shock test consisting of 3000 cycles between 5 C and 80 C. During the lifetests gas generation within all of the heat pipes was detected, resulting in a steadily increasing length of blocked condenser section. Due to the degrading longterm performance of the Al/SS/NH3 heat pipes, some of these were replaced by one-metal heat pipes made from stainless steel. The lifetest of three heat pipes was discontinued prior to the planned lapse of 3 years. These heat pipes were cut open to analyze working fluid and any deposits on the inner heat pipe surfaces. Author (ESA)

N78-13399# European Space Agency, Paris (France).
RESOLUTION OF THE NAVIER-STOKES EQUATIONS BY A FINITE ELEMENT METHOD
Michel Borrel Nov. 1977 131 p refs Transl. into ENGLISH of 'Resolution des Equations de Navier-Stokes par une Methode d'Elements Finis', ONERA, Paris Report ONERA-NT-1977-8, 1977 Original report in FRENCH previously announced as N77-31461
(ESA-TT-425; ONERA-NT-1977-8) Avail: NTIS HC A07/MF A01

A finite element method for the numerical calculation of viscous, incompressible, laminar flows, from the steady Navier-Stokes equations, was studied both theoretically and as regards its implementation. First, the mathematical frame of the Navier-Stokes equations being set, the principle of the method is presented, with a study of convergence and of estimation of the approximation error. Then, the implementation of the various parts of the computing program is presented, with numerical results obtained for flows at various Reynolds numbers: (1) in a square cavity and, (2) within a domain around the trailing edge of an airfoil and including a zone where the boundary layer approximation is no longer valid. An appendix gives the calculation of the incompressible ideal flow around an air foil at incidence, first step of an iterative process based on the determination and coupling of several calculation zones. Author (ESA)

N78-13260*# Energy Research and Development Administration, Morgantown, W. Va. Energy Research Center.
GRAVITY FLOW RATE OF SOLIDS THROUGH ORIFICES AND PIPES
J. F. Gardner, J. E. Smith, and J. M. Hobday *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 519-536 refs (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 20D

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N78-13400* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OPTICALLY SELECTIVE, ACOUSTICALLY RESONANT GAS DETECTING TRANSDUCER Patent
John Dimeff, inventor (to NASA) Issued 25 Oct. 1977 6 p Filed 22 Dec. 1975 Supersedes N77-19388 (15 - 10, p 1310)
(NASA-Case-ARC-10639-1; US-Patent-4,055,764; US-Patent-Appl-SN-643043; US-Patent-Class-250-336; US-Patent-Class-250-343; US-Patent-Class-250-351) Avail: US Patent Office CSCL 14B

A gas analyzer is disclosed which responds to the resonant absorption or emission spectrum of a specific gas by producing an acoustic resonance in a chamber containing a sample of that gas, and which measures the amount of that emission or absorption by measuring the strength of that acoustic resonance, e.g., the maximum periodic pressure, velocity or density achieved. In the preferred embodiment, a light beam is modulated periodically at the acoustical resonance frequency of a closed chamber which contains an optically dense sample of the gas of interest. Periodic heating of the absorbing gas by the light beam causes a cyclic expansion, movement, and pressure within the gas. An amplitude is reached where the increased losses were the cyclic radiation energy received. A transducing system is inclined for converting the pressure variations of the resonant gas into electronic readout signals.
Official Gazette of the U.S. Patent Office

N78-13401 British Library Lending Div., Boston Spa (England).
THE ACCURACY OF PYRHELIOMETERS IN MEASURING RADIATION
V. A. Klevantsova [1977] 8 p refs Transl. into ENGLISH from Nauchn.-Issled. Gidromet. Inst., Radiat. Process. Atmos. Earth's Surf. (Kiev), 1974 p 301-303 In RUSSIAN and ENGLISH
(BLL-M-24928-(5828.4F); BLL-Trans-1297) Avail: British Library Lending Div., Boston Spa, Engl.

Sources of the radiation measurement errors of pyrheliometers are summarized. It is concluded that the error caused by circumsolar radiation in the readings and temperature errors are systematic. All other errors are considered random. J.M.S.

N78-13402 British Library Lending Div., Boston Spa (England).
POSSIBLE ERRORS IN CALIBRATING PYRANOMETERS IN CONNECTION WITH VARIABILITY IN ATMOSPHERIC SPECTRAL TRANSPARENCY
K. A. Tavartkiladze [1977] 9 p refs Transl. into ENGLISH from Ukr. Nauch.-Issled. Gidromet. Inst., Radiat. Process. Atmos. Earth's Surf. (Kiev), 1974 p 330-333 In ENGLISH and RUSSIAN
(BLL-M-24927-(5828.4F); BLL-Trans-1299-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Eng.

Possible error arising in the calibration of the Yanishevskiy pyromometer was determined. The spectral intensity of direct solar radiation was computed. The ozone transmission function was estimated along the solar rays in terms of the absorption coefficients for a total ozone amount of 0.3 atm cm. B.B.

N78-13403 British Library Lending Div., Boston Spa (England).
A NEW ABSOLUTE THERMOELECTRIC RADIOMETER
O. A. Gerashchenko and S. A. Sazhina [1977] 10 p refs Transl. into ENGLISH from Nauchn.-Issled. Gidromet. Inst., Radiat. Process. Atmos. Earth's Surf. (Kiev), 1974 p 340-343 In RUSSIAN and ENGLISH
(BLL-M-24938-(5828.4F); BLL-Trans-1300) Avail: British Library Lending Div., Boston Spa, Engl.

The instrument described is used in studying the processes

of radiation energetics, for example in measuring integral heat fluxes. It may also be employed in various actinometric measurements: to study energy balance, measure direct solar radiation and other meteorological elements. The circuit design of the instrument is diagrammed, and it is shown that the sensitive element is provided by a thermal flux meter. A thermoelectric transducer and aluminum laminae, covered with 'black-body' pigment of known integral and spectral absorptivity are also necessary components. In the working range of the instrument, the functional relationship between the meter signal and the absorbed radiative electrical energy is almost linear and is reproduced with an error no worse than 0.5%. Author

N78-13404 British Library Lending Div., Boston Spa (England).
AN ALUMINUM OXIDE HUMIDITY ELEMENT FOR RADIOSONDES
M. B. Fridzon and N. L. Sholokhova [1977] 13 p refs Transl. into ENGLISH from Tr. Tsentr. Aerolog. Observ. (Moscow), Issue 17, 1976 p 118-125 In RUSSIAN and ENGLISH
(BLL-M-24937-(5828.4F); BLL-Trans-1279) Avail: British Library Lending Div., Boston Spa, Engl.

An oxide coating was formed on samples of 99.99% pure aluminum using a bath with lead cathodes and a consatant current. The anodes were aluminum rods and the electrolyte was a 20% solution of chemically pure sulphuric acid. Following washing and drying of the sample at a temperature of 150 C, a layer of gold 400 to 600 A thick was vapor deposited onto its surface. A terminal wire was affixed to the upper contact layer using an electrically conducting adhesive. The effectiveness of the aluminum oxide elements when in flight in the free atmosphere was investigated and their readings compared with those from a network radiosonde, during radiosonde ascents using both aluminum oxide and plastic film elements. Author

N78-13405# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
A LASER-RAMAN OPTICAL MULTICHANNEL ANALYZER FOR TRANSIENT GAS CONCENTRATION PROFILE
Philip C. Black and Richard K. Chang 23 Nov. 1977 36 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Mar. 1978
Avail: NTIS HC A03/MF A01

An optical multichannel analyzer recorded simultaneously the spatially distributed Raman intensity or the frequency distributed Raman spectrum with 0.01 mm or 0.12 nm resolution, respectively. Preliminary laser Raman results of 1 msec temporal resolution on the gas concentration profile of a jet emerging from a nozzle and the average gas temperature within a stable flame are presented. The details of the newly developed optical multichannel analyzer, the experimental configurations to measure the gas density and flame temperature, and the advantages and limitations of using this analyzer to study turbulence and nonequilibrium processes are discussed. Author

N78-13406*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
MICROBIAL LOAD MONITOR
R. S. Caplin and E. R. Royer 1 Nov. 1977 18 p
(Contract NAS9-11877)
(NASA-CR-151565; MDC-E1781) Avail: NTIS HC A02/MF A01 CSCL 14B

Design analysis of a microbial load monitor system flight engineering model was presented. Checkout of the card taper and media pump system was fabricated as well as the final two incubating reading heads, the sample receiving and card loading device assembly, related sterility testing, and software. Progress in these areas was summarized. Author

N78-13407*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RELIABILITY ANALYSIS OF FORTY-FIVE STRAIN-GAGE SYSTEMS MOUNTED ON THE FIRST FAN STAGE OF A YF-100 ENGINE
Raymond Holanda and Lloyd M. Frause Sep. 1977 20 p refs
(NASA-TM-73724; E-9274) Avail: NTIS HC A02/MF A01 CSCL 14B

The reliability of 45 state-of-the-art strain gage systems under full scale engine testing was investigated. The flame spray process was used to install 23 systems on the first fan rotor of a YF-100 engine; the others were epoxy cemented. A total of 56 percent of the systems failed in 11 hours of engine operation. Flame spray system failures were primarily due to high gage resistance, probably caused by high stress levels. Epoxy system failures were principally erosion failures, but only on the concave side of the blade. Lead-wire failures between the blade-to-disk jump and the control room could not be analyzed. Author

N78-13408*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A GAS FILTER CORRELATION MONITOR FOR CO, CH4, AND HCl
Daniel I. Sebacher Dec. 1977 30 p refs
(NASA-TP-1113; L-11868) Avail: NTIS HC A03/MF A01 CSCL 14B

A fast response instrument for monitoring the atmospheric constituents CO, CH4, and HCl, using a modified nondispersive infrared technique, was designed, assembled, and tested. This gas filter correlation method uses a sample of gas to provide a selective filter for radiation absorbed in a gas mixture containing the specified gas. Depending on the spectral line broadening, temperature, and optical depth of the gas selected, exceptionally high spectral resolution may be attained. A description of the single beam rotating cell system and its specific application is presented along with the signal processing circuit. Calibrations of the instrument show that the technique can be used to measure CO, CH4, and HCl concentrations as small as 5 ppm-m. A field version was employed to measure diurnal variations of CO and CH4 and the interfering effects of other atmospheric gases were analyzed. Author

N78-13409# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
THE FORMATION AND OPTIMIZATION OF INTERFEROMETRIC FRINGES
Benjamin J. Pernick and Kenneth G. Leib Sep. 1977 38 p refs
(AD-A045144; RM-632) Avail: NTIS HC A03/MF A01 CSCL 14/5

Expressions to describe fringe contours in the region of interference of two coherent beams are derived for three combinations of plane and spherical wave geometries. The fringe contrast ratio is shown to be spatially variable whenever spherical wavefronts are involved and can be controlled by altering the reference to signal beam intensity ratio. These expressions can be applied during the fabrication of matched filters or holographic lenses. Author (GRA)

N78-13410# Environmental Monitoring and Support Lab., Cincinnati, Ohio. Instrumentation Development Branch.
INVESTIGATION OF THE ORION RESEARCH AMMONIA MONITOR
Robert J. OHerron May 1977 40 p refs
(PB-271648/8; EPA-600/4-77-028) Avail: NTIS HC A03/MF A01 CSCL 14B

Laboratory tests under controlled environmental conditions showed the electronic stability (drift) to be well within + or - 10 percent of reading over the temperature range 5c to 42C. Sensor stability over the temperature range 5C to 42C was tested by applying ammonia nitrogen (standard solutions of 10 mg/1, 50 mg/1, and 100 mg/1) as direct input to the monitor. The results of these tests showed that automatic restandardization maintained readings within Orion's specified tolerance of + or - 10 percent of reading. Dynamic on-stream measurements were made of a secondary sewage treatment plant effluent in a field installation. GRA

N78-13411# Phoenix Corp., McLean, Va.
OPTIMIZED METHOD FOR THE DERIVATION OF THE DEFLECTION OF THE VERTICAL FROM RGSS DATA
John Lyon, G. L. Mader, and F. T. Heuring 7 Oct. 1977 42 p refs
(Contract DAAK70-77-C-0126)
(AD-A045618; FTL-0122) Avail: NTIS HC A03/MF A01 CSCL 17/7

The Rapid Gravity Survey Systems (RGSS) provides a means

of quickly measuring precisely non-astrogeodetic values of the deflections of the vertical. A test vehicle carries an Inertial Positioning System (IPS) which at each of the vehicle's stops produces an error velocity which can be related to the inertial platform tilt errors and the deflections of the vertical. An optical determination of the gyro drifts and the deflections of the vertical can only be obtained by a post-mission smoothing of the data. In this case, accurate data are available a priori for the deflections of the vertical at the start and stop of the vehicle's mission -- as well as the data on the IPS velocity errors at each stop. The purpose of this report is to develop the equations for the position, velocity, and tilt angle errors into a useable algorithm for the optimal estimation of the deflections of the vertical. As a result, three major analytic tasks are presented. This mathematical development enables the production of a machine algorithm for use with actual data. The final section of the report contains a coded version of the algorithm with explanatory comments. Author (GRA)

N78-13412# State Univ. of New York, Binghamton.
TEXTURE TONE FEATURE EXTRACTION AND ANALYSIS Final Technical Report, Apr. 1976 - May 1977
Shin-yi Hsu and Eugene Klimko Aug. 1977 50 p refs
(Contract F30602-76-C-0211)
(AD-A045542; RADC-TR-77-279) Avail: NTIS HC A03/MF A01 CSCL 14/5

A new texture measurement and the Mahalanobis classifier with a generalized inverse scheme were developed to generate decision maps of terrain features with digitized B/W photographs on a pixel by pixel basis. Eight scenes within the Northeast test area, four low altitude and four high altitude, were analyzed yielding a hit-rate of about 90% with properly digitized image data. To determine the degree of non-normal behavior of the texture variables, the stable distribution models were utilized. Methods of estimating the stable parameters of the texture variables were developed. It is found that fifty % of the texture variables are not normally distributed. Since the stable distribution models are capable of incorporating the skewness parameters into the classification process, it is recommended as a new classifier for image data analysis. GRA

N78-13413# Oak Ridge National Lab., Tenn.
PRECISION RECTIFIER DETECTORS FOR AC RESISTANCE BRIDGE MEASUREMENTS WITH APPLICATION TO TEMPERATURE CONTROL SYSTEMS FOR IRRADIATION CREEP EXPERIMENTS Ph.D. Thesis
M. G. Duncan May 1977 352 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5715) Avail: NTIS HC A16/MF A01

The suitability of several temperature measurement schemes for an irradiation creep experiment is examined. It was found that the specimen resistance can be used to measure and control the sample temperature if compensated for resistance drift due to radiation and annealing effects. A modified Kelvin bridge was presented that allows compensation for resistance drift by periodically checking the sample resistance at a controlled ambient temperature. A phase-insensitive method for detecting the bridge error signals was presented. The phase insensitive detector is formed by averaging the magnitude of two bridge voltages. Although this method is substantially less sensitive to stray reactances in the bridge than conventional phase-sensitive detectors, it is sensitive to gain stability and linearity of the rectifier circuits. Accuracy limitations of rectifier circuits were examined both theoretically and experimentally in great detail. Both hand analyses and computer simulations of rectifier errors were presented. ERA

N78-13414# Sandia Labs., Albuquerque, N. Mex.
GENERALIZED BINARY COMPUTER GENERATED HOLOGRAMS: NOISE PROCESSES
B. D. Hansche Apr. 1977 130 p refs
(Contract EY-76-C-04-0789)
(SAND-76-0734) Avail: NTIS HC A07/MF A01

In the GBH, multiple apertures (subcells) are used in each cell, to code a complex amplitude transmittance by the detour phase principle. It allows maximum use of available graphics device resolution, and is therefore best suited for plotting holograms on graphics devices which have only a limited number of addressable points, such as storage tube terminals. Some noise processes particular to the GBH code are studied. The effects of quantization noise are studied first. For transmittance functions which are bounded in amplitude, it is usually beneficial to normalize the function so that a few of the available quantization levels are not used. With some typical signal types an RMS quantization noise of 1.5 to 2 percent can be expected. Oversampling tends to reduce the quantization error. A phase error which results because the subcells differ slightly in location from the sampling location is analyzed. ERA

N78-13415# EMI Electronics Ltd., Hayes (England). Electron Tube Div.
STUDY OF MICROCHANNEL PLATE INTENSIFIERS FOR IMAGE PHOTON COUNTING
G. Ashe Paris ESA Jan. 1977 52 p refs
(Contract ESTEC-2658/76)
(EMI-ETD-9; ESA-CR(P)-975) Avail: NTIS HC A04/MF A01

Techniques for the construction of an image intensifier incorporating a microchannel plate were studied. The performance of the microchannel plate resulting in a theoretical specification is discussed. The proposed design of an image tube incorporating the plate is given. The theoretical specification of the complete image intensifier is outlined. The performance is compatible with the requirements of a high quality image photon counting detector. ESA

N78-13416# Electricity Council Research Center, Capenhurst (England).
A POLYETHYLENE SHIELDED GLOBE THERMOMETER
D. A. McIntyre May 1976 22 p refs
(ECRC/N940) Avail: NTIS HC A02/MF A01

The construction and use of an improved globe thermometer for the measurement of mean radiant temperature (MRT) is described. The device consists of a 50 mm hollow copper sphere in the center of a 100 mm diameter polyethylene envelope. The figure of merit of the device is about 0.75 in still air falling to 0.7 in an air speed of 0.5 m/s. The corresponding figures for the standard globe thus has a higher sensitivity to thermal radiation than the conventional globe, coupled with lower sensitivity to air movement. Where an index of warmth is required, rather than a measure of MRT, it is shown that the warmth of an environment, described by the subjective temperature, may be obtained from the temperature of an unshielded 25 mm globe thermometer and the air speed. Author (ESA)

N78-13417# National Bureau of Standards, Washington, D. C. Center for Building Technology.
A NEW PORTABLE TESTER FOR THE EVALUATION OF THE SLIP-RESISTANCE OF WALKWAY SURFACES Final Report
Robert J. Brungraber 1977 55 p refs
(PB-270969/9; NBS-TN-953) Avail: NTIS HC A04/MF A01 CSCL 14B

Available devices for testing the slip-resistance developed between walkway surfaces and shoe sole or heel materials are described. The limitations of available testers are detailed, and the need for a more reliable tester that can be used on actual floors under true field conditions, such as in the presence of water was shown. GRA

N78-13418# International Biophysics Corp., Irvine, Calif.
ALARM-LEVEL MONITOR FOR SO2 EMISSIONS FROM STATIONARY SOURCES Final Report, Jul. 1975 - May 1976
Donald A. Wallace and Wayne Perkins Feb. 1977 34 p
(Contract EPA-68-02-2233)
(PB-271656/1; EPA-600/2-77-021) Avail: NTIS HC A03/MF A01 CSCL 14B

A field prototype, alarm level monitor for SO2 emissions from stationary sources was designed, fabricated and tested. The monitor was designed to be inexpensive, simple to operate and easily maintained. The monitoring system is an extractive type that employs an air aspirator to pull a sample through a probe and sample conditioning assembly. The gas sample flows through an analyzer that contains an electrochemical cell as the sensing element. The analyzer has the sensitivity to detect SO2 concentrations in a single range from 0 to 1000 parts per million.

Visual and audible alarms are activated when SO2 emissions are in excess of a preset level. GRA

36 LASERS AND MASERS

Includes parametric amplifiers.

N78-13419 California Univ., Berkeley.
FLASH PHOTOLYSIS: LASER STUDIES AND SOURCE CHARACTERIZATION Ph.D. Thesis
James Vernon Beitz 1976 326 p
Avail: Univ. Microfilms Order No. 77-15605

Studies of high energy, short pulse duration, low fill pressure quartz wall flashlamps are reported. Available flashlamp electrical theories were tested and found to be of only quantitative use of the observed values of energy (to 4.4 kj), pressure (0.1 to 30 torr), and time. Use of a sensitive in-cavity dye laser gain probing technique failed to demonstrate net positive gain on phosphorescence emission transitions in acetophenone. Gain probing experiments also indicate that under isothermal, 300 K, reaction conditions, the H + ClF, reaction predominantly produces HF in its first excited state. Estimates of the rate constant for this previously unknown reaction, 3 x 10 to the 6th power per (torr x sec) or larger, are near the gas kinetic limit.
Dissert. Abstr.

N78-13420*# Rockwell International Corp., Anaheim, Calif.
ANALYSIS AND DESIGN OF A HIGH POWER LASER ADAPTIVE PHASED ARRAY TRANSMITTER Final Report
G. E. Mevers, J. F. Soohoo, J. Winocur, N. A. Massie, W. H. Southwell, R. A. Brandewie, and C. L. Hayes Dec. 1977 190 p refs
(Contract NAS3-18937)
(NASA-CR-134952; C75-537/501) Avail: NTIS HC A13/MF A01 CSCL 20E

The feasibility of delivering substantial quantities of optical power to a satellite in low earth orbit from a ground based high energy laser (HEL) coupled to an adaptive antenna was investigated. Diffraction effects, atmospheric transmission efficiency, adaptive compensation for atmospheric turbulence effects, including the servo bandwidth requirements for this correction, and the adaptive compensation for thermal blooming were examined. To evaluate possible HEL sources, atmospheric investigations were performed for the CO2, (C-12)(O-18)2 isotope, CO and DF wavelengths using output antenna locations of both sea level and mountain top. Results indicate that both excellent atmospheric and adaption efficiency can be obtained for mountain top operation with a micron isotope laser operating at 9.1 um, or a CO laser operating single line (P10) at about 5.0 (C-12)(O-18)2um, which was a close second in the evaluation. Four adaptive power transmitter system concepts were generated and evaluated, based on overall system efficiency, reliability, size and weight, advanced technology requirements and potential cost. A multiple source phased array was selected for detailed conceptual design. The system uses a unique adaption technique of phase locking independent laser oscillators which allows it to be both relatively inexpensive and most reliable with a predicted overall power transfer efficiency of 53%. Author

N78-13421*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SMALL-SIGNAL GAIN DIAGNOSTIC MEASUREMENTS IN A FLOWING CO2 PIN DISCHARGE LASER
R. A. Blech, E. J. Manista, and J. W. Dunning, Jr. Nov. 1977 17 p refs
(NASA-TM-73843; E-9430) Avail: NTIS HC A02/MF A01 CSCL 20E

Small-signal gain diagnostic measurements were conducted on closed loop, high power, carbon dioxide laser to assess the coupling between gas flow velocity and resonator saturation. Parameters investigated included optical cavity and discharge power. Results of gain measurements within and downstream of the excitation volume are presented for a laser gas composition He:N2:CO2 of 10:7:1 at 90 torr. The gain at constant discharge power was observed to be dependent upon discharge power level and time. An important result of this study is that the effects of gain swept downstream of the discharge region must be considered in the resonator design if efficient extraction of stored optical energy is desired. Author

N78-13422*# Arkansas Univ., Fayetteville. Computing Services.
DATA PROCESSING AND DISPLAY OF LASER DOPPLER EXPERIMENTAL RESULTS, VOLUME 1 Final Report
B. R. Ashmore, A. Kimura, and R. W. Skeith Sep. 1976 345 p ref
(Contract NAS8-31771)
(NASA-CR-150441) Avail: NTIS HC A15/MF A01 CSCL 20E

Contract activities performed in developing a laser Doppler system for detecting, tracking, and measuring aircraft wake vortices are summarized. The computer program for processing and displaying the Dust Devil experimental data is presented. Program listings are included in the appendix. Author

N78-13423*# Arkansas Univ., Fayetteville. Dept. of Industrial Engineering.
DATA PROCESSING AND DISPLAY OF LASER DOPPLER EXPERIMENTAL RESULTS, VOLUME 2
Sep. 1976 340 p
(Contract NAS8-31771)
(NASA-CR-150442) Avail: NTIS HC A15/MF A01 CSCL 20E

Velocity cell display diagrams for NASA Project Dust Devil laser Doppler experiments are presented. I.M.

N78-13424# Arizona Univ., Tucson.
COHERENT X-RAYS BY STIMULATED EMISSION OF RADIATION Final Report, 1 Apr. 1974 - 31 May 1977
John D. McCullen and Marlan O. Scully Oct. 1977 7 p refs
(Grants DAHC04-74-G-0136; DAHC04-75-G-0136)
(AD-A045724; ARO-12162.4-P; ARO-15274.1-P.) Avail: NTIS HC A02/MF A01 CSCL 20/5

Substantial progress has been made towards the realization of a short-wavelength charge-exchange laser which is driven by pulsed capacitor discharge. Parallel experimental and theoretical efforts have led to the point that observation of laser action is believed to be imminent. The basic resonant charge-exchange reaction studied is He(+) + Cs He^{*} + CS(+). Author GRA

N78-13425# Materials Research Labs., Maribyrnong (Australia).
HIGH-PRESSURE DISCHARGE FOR CO2 LASERS
R. McLeary and P. J. Beckwith May 1977 20 p refs
(AD-A045448; MRL-R-687) Avail: NTIS HC A02/MF A01 CSCL 20/5

This report describes the characteristics of continuous electric discharges stabilised by the plasma-injection technique. The gases investigated are N2 and mixtures of N2 and CO2 that are suitable for use in CO2 lasers. Discharge characteristics are presented for wide ranges of pressure, discharge length and gas mixture. Stable discharges in N2 have been achieved at power densities up to 200 MW/cu. m. (200 kW/litre) at atmospheric pressure. Author (GRA)

N78-13426# Ohio State Univ., Columbus. ElectroScience Lab.
LASER ATMOSPHERE ABSORPTION STUDIES Interim Report, Jul. 1976 - May 1977
Ronald K. Long, E. K. Damon, R. J. Nordstrom, J. C. Peterson, and M. E. Thomas Griffiss AFB, N. Y. RADC Sep. 1977 86 p refs
(Contract F30602-76-C-0058; ARPA Order 1279)
(AD-A045821; RADC-TR-77-248) Avail: NTIS HC A05/MF A01 CSCL 20/5

This report describes progress on the various tasks which comprise the research in laser atmospheric propagation. This work includes (1) a review of work done on the study of the infrared water vapor continuum, (2) the design of low stainless steel, temperature controlled absorption cells with White-type optics, (3) design of a non-resonant, differential spectrophone and data recorded on this instrument, (4) design of a stainless steel, resonant spectrophone, and (5) other topics. Author (GRA)

N78-13427# Texas Instruments, Inc., Dallas. Central Research Labs.

MONOLITHIC LASER Final Technical Report, 1 May 1973 - 31 Jun. 1977

Kenneth L. Lawley Sep. 1977 113 p
(Contract N00014-73-C-0288; RF41423001)
(AD-A045672; TI-08-77-19; TI-288-016-1F-ONR; ONR-288-016-1F) Avail: NTIS HC A06/MF A01 CSCL 20/5

This report describes the accomplishment of a three-phased exploratory research program under Contract No. N00014-73-C-0288 to develop the first integrated optical transmitter. The initial efforts involved the development of a unique (Ga,In) As surface laser and high index infrared glass waveguides. The surface laser is a vapor-grown mesa structure with vertical grown crystalline facets furnishing the optical feedback. The structure can be placed and grown at will on a GaAs substrate using conventional photolithographic techniques. This unique laser structure represents a radical departure from conventional semiconductor laser technology. Ternary alloy Ga1-xInxAs mesas with 0-x-0.2 were grown and the details of their morphology determined. Optically pumped laser emission from mesas with 0-x-0.1 has been observed. Threshold pump powers, efficiencies, and emission characteristics have been determined. Also, a GaAs and Ga1-xInxAs(x - 0.8) mesa diode laser was successfully fabricated. The p-n junction was formed by Zn diffusion and implantation into the top of the mesas. The Ga1-xInxAs homojunction lasers are the first wavelength-tunable, monolithic electrical injection lasers and have been operated between liquid nitrogen and room temperatures. Monolithic arrays of up to six mesa laser have been operated with all the lasers oscillating simultaneously. Because these devices are homojunctions, their threshold current densities at room temperature are very high (approx 170 ka sq.cm.), and their efficiencies are low. GRA

N78-13428# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.

TARGET RECOGNITION USING MULTIPLE DISCRIMINANTS FROM AN INFRARED SEEKER

William E. Webb 24 Jun. 1977 22 p refs
(DA Proj. 1L3-62303-A-214)
(AD-A045223; DRDMI-TE-77-16) Avail: NTIS HC A02/MF A01 CSCL 20/5

It has been suggested that a laser designator could be adapted to measure certain characteristics of the object being designated and that these measurements could be a useful aid in target recognition and/or identification. Characteristics that could be measured include size, motion (speed), vibration, and quantities relating to the target surface such as reflectance, depolarization, etc. Unfortunately, it appears unlikely that any single target characteristic will be sufficiently unique to provide an unequivocal identification. In this report, consideration is given to statistical methods for combining several target characteristics to enhance the identification capability. The technique studied involves using multivariate statistical analysis to construct a linear or quadratic discriminant function on the various measured quantities. It is shown that using this approach, an automatic target recognition feature could be implemented at very small additional cost. The final section of this report details the experimental data needed to assess completely the feasibility of the proposed identification aid and recommends an experimental program for collecting these data. Author (GRA)

N78-13429# California Univ., Livermore. Lawrence Livermore Lab.

LASER SPECTROSCOPY AND LASER ISOTOPE SEPARATION IN HEAVY ATOMS

R. W. Solarz and J. A. Paisner 1977 34 p Presented at A.A. Advancement of Sci. Conf., Denver, Colorado, 20 Feb. 1977
(Contract W-7405-eng-48)
(UCRL-78967; Conf-770210-1) Avail: NTIS HC A03/MF A01

The impact which laser spectroscopic techniques have had in the study of the atomic spectra of heavy elements and that of uranium in particular is discussed. Author (ERA)

N78-13430# Sandia Labs., Albuquerque, N. Mex.

EFFECTS OF CHEMICAL KINETICS AND STARTING MATERIAL REGENERATION ON THE EFFICIENCY OF AN IODINE LASER AMPLIFIER

George A. Fisk May 1977 19 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0880) Avail: NTIS HC A02/MF A01

A model of the chemical kinetics occurring in an iodine laser amplifier is presented and used to calculate the degree to which the starting material is consumed as a result of laser operation. The cost of purchasing new starting material is estimated and shown to be prohibitive. A scheme for regenerating the starting material from the species present in the amplifier after lasing is proposed. It is shown that the estimated efficiency of this chemical regeneration process is appreciably higher than the projected optimum efficiency of the pumping process. ERA

N78-13431# Los Alamos Scientific Lab., N. Mex.

NEUTRON/PHOTON/ELECTRON SHIELDING STUDY FOR A LASER-FUSION FACILITY

William L. Thompson 1977 9 p Presented at 5th Intern. Conf. on Reactor Shielding, Knoxville, Tenn., 18 Apr. 1977
(Contract W-7405-eng-36)
(LA-UR-77-910; Conf-770401-20) Avail: NTIS HC A02/MF A01

A Monte Carlo shielding study encompassing neutron, photon, and electron transport was conducted. The application of the Monte Carlo technique and several variance reduction schemes to the study is described. The calculations involve a geometry which is complicated in all three dimensions, a very intense 14 MeV neutron source, skyshine and deep penetrations. The facility design with 1.83 m concrete walls and a 1.52 m concrete roof is based on these calculations. ERA

N78-13432# Los Alamos Scientific Lab., N. Mex.

ADVANCED LASER TECHNOLOGY FOR LASER-INDUCED FUSER APPLICATIONS

Robert L. Carman 1976 34 p refs Presented at 4th Workshop on Laser Interaction and Related Plasma Phenomena, Troy, N. Y., 8-12 Nov. 1976
(Contract W-7405-eng-36)
(LA-UR-77-206; Conf-761155-5) Avail: NTIS HC A03/MF A01

Crucial issues involved in laser design reviewed include obtaining complete flexibility and control of laser energy, and methods for increasing laser efficiency. Particular emphasis is given to the design of optimized amplifiers. Constraints on amplifier diameters for steady state pumping are discussed and a two photon amplifier in atomic iodine is anlayzed. ERA

N78-13433# Bendix Corp., Kansas City, Mo. Technical Communications Div.

MEASUREMENT OF PEAK OPTICAL POWER FROM LASER DIODES

L. D. Wonnell Nov. 1976 33 p refs Presented at IEEE Mid-Am. Electron. Conf., Overland Park, Kans., 9 Nov. 1976
(Contract EY-76-C-04-0613)
(BDX-613-1719; Conf-761128-3) Avail: NTIS HC A03/MF A01

An improved method for measuring the peak power output from pulsed-injection laser diodes having risetimes of 10 ns or greater was developed. Based on the combination of an integrating sphere and a silicon photodiode, the system provides the means for collecting all of the widely divergent pulsed output of laser diodes. System accuracy is estimated to be within + or -15%. Methods of system calibration are described along with the circuitry used to pulse and measure the diode current. ERA

N78-13434# Institut Franco-Allemand de Recherches, St. Louis (France).

CW COHERENT ANTI-STOKES RAMAN SCATTERING FROM GASES

A. Hirth and K. Vollrath 22 Jun. 1976 14 p refs Presented at the 9th Intern. Conf. on Quantum Electron., Amsterdam, 14-18 Jun. 1976
(ISL-CO-216/76) Avail: NTIS HC A02/MF A01

Coherent anti-Stokes Raman Scattering (CARS) is discussed as a promising method for high resolution spectroscopy and as a new technique for density and temperature measurement in gas dynamics. Experiments with a continuous wave (CW) high

power CARS arrangement which uses the total intracavity power from two CW laser sources are described. ESA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N78-13435 Materials Research Labs., Melbourne (Australia).
ANTIFUNGAL SEALING RINGS: A NEW APPROACH
P. Dunn and D. Oldfield Oct. 1977 36 p refs Presented at the 4th Australian Rubber Technol. Conv., Surfer's Paradise, Queensland, Australia, 5-8 Oct. 1977; sponsored by PRI
(MRL-R-689; AR-000-658) Copyright. Avail: Issuing Activity

Development and performance of special vulcanizates used in sealing applications are reported. The use of conventional, monometric fungicides has been replaced by polymeric organotin compounds covulcanized into the rubber network. Polychloroprene, acrylonitrile-butadiene rubber and ethylene-propylene terpolymer rubbers have been evaluated by the use of O-rings to form sealed cavities with ten different materials (two metals, seven plastics and glass), in specially designed assemblies. Trials held over 3 years in adverse environments have confirmed that the rubbers are compatible with the sheet materials, and can be formed into efficient sealing products that will prevent fungal growth, have good performance characteristics, and do not degrade the optical qualities of transparent materials. Author

N78-13436* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD OF FORMING METAL HYDRIDE FILMS Patent
Robert Steinberg, Donald L. Alger, and Dale W. Cooper, inventors (to NASA) Issued 25 Oct. 1977 5 p Filed 20 Feb. Supersedes N76-18262 (14 - 09, p 1100)
(NASA-Case-LEW-12083-1; US-Patent-4,055,686; US-Patent-Appl-SN-659882; US-Patent-Class-427-124; US-Patent-Class-427-126; US-Patent-Class-427-255; US-Patent-Class-427-248E; US-Patent-Class-427-250; US-Patent-Class-250-499; US-Patent-Class-313-61S) Avail: US Patent Office CSCL 13H

The substrate to be coated (which may be of metal, glass or the like) is cleaned, both chemically and by off-sputtering in a vacuum chamber. In an ultra-high vacuum system, vapor deposition by a sublimator or vaporizer coats a cooled shroud disposed around the substrate with a thin film of hydride forming metal which getters any contaminant gas molecules. A shutter is then opened to allow hydride forming metal to be deposited as a film or coating on the substrate. After the hydride forming metal coating is formed, deuterium or other hydrogen isotopes are bled into the vacuum system and diffused into the metal film or coating to form a hydride of metal film. Higher substrate temperatures and pressures may be used if various parameters are appropriately adjusted.
Official Gazette of the U.S. Patent Office

N78-13437 British Library Lending Div., Boston Spa (England).
BEHAVIOR OF TURBOCHARGED 4 STROKE DIESEL ENGINES AT GREAT ALTITUDE
Karlheinz Halupka [1977] 16 p Transl. into ENGLISH from Motortech. Z. (West Ger.), v. 21, no. 9, Sep. 1960 p 359-363 In GERMAN and ENGLISH
(BLL-M-24934-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Output and specific fuel consumption of a diesel engine were calculated. Atmospheric conditions including atmospheric moisture, partial water, vapor pressure, and air pressure were considered in the computations. Author

N78-13438*# Perkin-Elmer Corp., South Pasadena, Calif. Boller and Chivens Div.
DESIGN STUDY OF THE DEEPSKY ULTRAVIOLET SURVEY TELESCOPE Final Report
N. A. Page, F. G. Callaghan, R. H. Killen, and W. Willis Aug. 1977 52 p refs Revised Original contains color illustrations
(Contract NAS9-14684)
(NASA-CR-151564; SPO-59170-Rev-A) Avail: NTIS HC A04/MF A01 CSCL 20F

Preliminary mechanical design and specifications are presented for a wide field ultraviolet telescope and detector to be carried as a Spacelab payload. Topics discussed include support structure stiffness (torsional and bending), mirror assembly, thermal control, optical alignment, attachment to the instrument pointing pallet, control and display, power requirements, acceptance and qualification test plans, cost analysis and scheduling. Drawings are included. A.R.H.

N78-13439*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN CONSIDERATIONS IN MECHANICAL FACE SEALS FOR IMPROVED PERFORMANCE. 1: BASIC CONFIGURATIONS
Lawrence P. Ludwig and Harold F. Greiner (Sealol, Inc., Providence, R. I.) 1977 20 p refs Presented at Winter Annual Meeting, Atlanta, Ga., 27 Nov. - 2 Dec. 1977
(NASA-TM-73735; E-9298-1) Avail: NTIS HC A02/MF A01 CSCL 11A

Basic assembly configurations of the mechanical face seal are described and some advantages associated with each are listed. The various forms of seal components are illustrated, and functions pointed out. The technique of seal pressure balancing and its application are described; and the concept of the PV factor, its different forms and limitations are discussed. Brief attention is given to seal lubrication since it is covered in detail in a companion paper. Finally, the operating conditions for various applications of low pressure seals (aircraft transmissions) are listed, and the seal failure mode of a particular application is discussed. Author

N78-13440*# National Aeronautics and Space Administration. Pasadena Office, Calif.
PLASMA IGNITER FOR INTERNAL COMBUSTION ENGINE Patent Application
Dennis J. Fitzgerald (JPL) and Robert R. Breshears, inventors (to NASA) (JPL) Filed 1 Apr. 1976 13 p
(Contract NAS7-100)
(NASA-Case-NPO-13828-1; US-Patent-Appl-SN-672636) Avail: NTIS HC A02/MF A01 CSCL 20A

An igniter for the fuel air mixture used in the cylinders of an internal combustion engine uses a conventional spark to initiate the discharge of a large amount of energy stored in the capacitor. A high current discharge of the energy in the capacitor switched on by a spark discharge produces a plasma and a magnetic field. The resultant combined electromagnetic current field forces the plasma deep into the combustion chamber thus providing an improved ignition of the fuel-air mixture in the chamber. NASA

N78-13441*# National Aeronautics and Space Administration. Pasadena Office, Calif.
MACHINE FOR FORMING A SOLAR ARRAY STRIP Patent Application
Robert L. Mueller (JPL), Robert Y. Yasui (JPL), Fred J. Cairo (JPL), Jerry K. Person (JPL), Ernest N. Costogue (JPL), Roy G. Downing (JPL), and Orwin Middleton, inventors (to NASA) (JPL) Filed 4 Nov. 1977 27 p
(Contract NAS7-100)
(NASA-Case-NPO-13652-2; US-Patent-Appl-SN-848794) Avail: NTIS HC A03/MF A01 CSCL 13H

A machine is described for attaching solar cells to a flexible substrate having printed circuitry. The strip is fed through a station where solar cells come into contact with solder pads for the printed circuitry and are simultaneously heated by an infrared lamp. The strip then passes to various stations where flux and solder residue are removed, the electrical performance of the soldered cells is determined, an encapsulating resin is deposited on the cells, and the encapsulated solar cells are examined for electrical performance. At the final station the resulting array is wound on a take-up drum. NASA

N78-13442# Naval Academy, Annapolis, Md.
PERFORMANCE ANALYSIS OF A MODIFIED INTERNAL COMBUSTION ENGINE Interim Report, 1976 - 1977
Timothy Lee Whited 23 May 1977 88 p refs
(AD-A045378; USNA-TSPR-90) Avail: NTIS

HC A05/MF A01 CSCL 21/7

The purpose of this study is to provide optical and other information on the processes undergone in the combustion and balancing chambers of the Naval Academy Heat Balanced Engine (NAHBE). In the NAHBE engine a pressure exchange cap is fitted on top of the piston to form a balancing chamber underneath. The pressure exchange between expansion and compression waves generated by this apparatus permits lower combustion temperatures and pressures, along with a significant decrease in pollutants emitted by the engine. The combustion cycle resulting from the pressure exchange cap is a combination of both the OTTO and Diesel cycles, with added advantages not found in either of these two cycles. Previous laboratory results have indicated: (1) up to 25% reduction of fuel consumption, (2) reduction in peak operating pressures from 660 to 470 psi and exhaust temperature reduction on the order of 50 F, (3) over 90% reduction in pollutants (carbon monoxide, hydrocarbons, and nitrogen oxides), depending on load and compression ratio, (4) multifuel capability (low octane gasoline, fuel oil, alcohol and water, alcohol and charcoal), and (5) significant noise reduction. High-speed photography was utilized for visualization of the processes. GRA

N78-13443# Army Construction Engineering Research Lab., Champaign, Ill.

THE EFFECTS OF WELD POROSITY ON THE FRACTURE TOUGHNESS OF A514F STEEL Interim Report

E. P. Cox Sep. 1977 29 p refs

(DA Proj. 4A7-62731-AT-41)

(AD-A045185; CERL-IR-M-227) Avail: NTIS HC A03/MF A01 CSCL 11/6

This report presents the results of an investigation conducted to evaluate the effects of clustered and linear porosity on the impact (dynamic tear) and dynamic fracture toughness of American Society for Testing and Materials (ASTM) A514 grade F steel welds. Tests were conducted using standard 1.59-cm dynamic tear specimens in a dynamic tear machine. Tests were also conducted using instrumentation recently developed for use with the dynamic tear machine. Results indicated that the upper shelf fracture toughness of welds containing clustered or linear porosity is sufficient to permit large-scale plastic deformation prior to fracture. However, the ductile-to-brittle transformation in welds containing linear porosity may be elevated to normal operating temperatures, thus increasing the possibility of catastrophic fracture. The instrumented dynamic tear test was found to provide a means of calculating dynamic fracture toughness values on the lower shelf and a lower bound for fracture toughness on the upper shelf in high-strength structural steels. Author (GRA)

N78-13444# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

MECHANICS OF CUTTING AND BORING. PART 6: DYNAMICS AND ENERGETICS OF TRANSVERSE ROTATION MACHINES

Malcolm Mellor Aug. 1977 45 p

(AD-A045127; CRREL-77-19) Avail: NTIS HC A03/MF A01 CSCL 13/9

The report deals with forces and power levels in cutting machines having a disc or drum that rotates about an axis perpendicular to the direction of advance. The forces on individual cutting tools are related to position on the rotor and to characteristics such as tool layout, rotor speed, rotor size, machine advance speed, and rotor torque. Integration leads to expressions for force components acting on the rotor axis, taking into account tool characteristics, cutting depth of the rotor, and rotor torque. These provide estimates of tractive thrust and thrust normal to the primary free surface. For self-propelled machines, this leads to considerations of traction, normal reaction, weight and balance, and power/weight ratios. Specific energy consumption is analyzed and related to machine characteristics and strength of the material being cut. Power per unit working area is discussed, and data for existing machines are summarized. Power requirements for ejection of cuttings are analyzed, and the hydrodynamic resistance on underwater cuttings is treated. A number of worked examples are given to illustrate the principles discussed in the report. Author (GRA)

N78-13445# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

COOLED WORKING BLADE OF A GAS TURBINE

A. A. Kantsepolskiy and S. Z. Kopelev 11 May 1977 8 p Transl. into ENGLISH from patent (USSR), n. 333278, 21 Mar. 1972 p 1-2

(AD-A045435; FTD-ID(RS)I-0673-77) Avail: NTIS HC A02/MF A01 CSCL 21/5

A cooled working blade of a gas turbine with a root, for example of the fir-tree type, in which an aperture is made for supply of cooling air, is distinguished by the fact that for the purpose of decreasing the leakage of cooling air, continuous projections are made with transverse slots on the edges of the root end for a footing which fixes the blade in an axial direction. Author (GRA)

N78-13446# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.

RELIABILITY PREDICTION FOR COMBUSTORS AND TURBINES, VOLUME 1 Final Report, 15 Jun. 1975 - 30 Nov. 1976

B. C. Schlein Jun. 1977 86 p refs

(Contract F33615-75-C-2057)

(AD-A045670; FR-8187-Vol-1; AFAPL-TR-77-8-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 21/5

Creep - low cycle fatigue and louver lip collapse have been established as primary gas turbine combustion chamber failure modes by observation of field service and in-house endurance test hardware. Analytical models for these two failure modes have been developed and incorporated into a mission analysis program. The mission analysis program relates the component environment (temperature, pressure and flow) to the aircraft engine and flight characteristics and thereby provides the forcing functions for the turbine and combustor failure models. The combined mission analysis - failure model program was used to predict component lives for transport and fighter/attack aircraft over representative missions. The sensitivity of the prediction system was established by perturbations to the mission and input parameters. GRA

N78-13447# Avco Systems Div., Wilmington, Mass.

ON BOARD VEHICLE SENSOR TECHNOLOGY. VOLUME 2: TECHNICAL REPORT Final Report, Jun. 1975 - Dec. 1976

R. Heldt and H. Burke Jul. 1977 308 p refs

(Contract DOT-HS-5-01178)

(PB-270925/1; AVSD-0353-76-RR; DOT-HS-802-485) Avail: NTIS HC A14/MF A01 CSCL 13F

Areas were identified in motor vehicle brake, steering, suspension, tire, lighting and signalling systems where safety or inspection benefits might be obtained through the application of on-board vehicle sensors utilizing either on-board or off-board readout. These areas were screened against a variety of criteria, the most important being their potential for accident reduction. Eleven candidate areas were then subjected to further analysis and a cost benefit analysis was performed for each candidate area, utilizing estimates of sensor life-cycle cost and benefit, including both safety and other impacts. Limited consideration was also given to alternative countermeasures in each area. Four candidate areas are judged to offer the potential of a favorable benefit/cost ratio. These are brake performance, tire tread depth, brake lights and brake friction material. GRA

N78-13448# National Highway Traffic Safety Administration, Riverdale, Md. Safety Research Lab.

EFFECT OF RATE OF CHANGE OF SLIP ON THE PEAK BRAKING COEFFICIENT OF PASSENGER CAR TIRES M.S. Thesis - Univ. of Maryland

Patrick L. Boyd and W. H. Walston Aug. 1977 75 p

(PB-270934/3; DOT-HS-802-513) Avail: NTIS HC A04/MF A01 CSCL 13F

The peak braking coefficient was measured for five tires at six rates of change of slip on three wet surfaces, and a slick tire was tested on dry asphalt. The difference in braking coefficient for a tire-pavement combination over the range of rates of change of slip varied from 3.6 to 33.6 percent. In general, the effect of rate of change of slip was more pronounced with slick tires and low coefficient surfaces. In cases where statistically significant

differences existed on wet surfaces, the highest coefficients occurred most often at intermediate rates of change of slip (between 36%/sec and 100%/sec), and the lower coefficients were usually measured at both very fast and very slow rates of change of slip. It is hypothesized that a reduction in the rate of change of slip causes an increase in the peak braking coefficient on a dry surface but increases the probability of partial hydroplaning on a wet surface. GRA

N78-13449# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
STRUCTURAL ANALYSIS OF A VANE FOR AN ADVANCED ENVIRONMENTAL CONTROL SYSTEM ROTARY VANED COMPRESSOR Final Report, Feb. 1976 - Feb. 1977
Kenneth P. Schwartz Jun. 1977 175 p refs
(AF Proj. 6146)
(AD-A045701; AFFDL-TR-77-49) Avail: NTIS MF A01 CSCL 01/3

The primary intent of this effort was to determine if the existing ROVAC vane could be improved from a total weight, operational bearing loads, and vane tip deflection point of view. To attain these improvements the use of advanced filamentary composite materials was suggested and studied. The analysis consisted of the generating of an automated vane modeling (AVM) computer program from which a NASTRAN finite element model of the ROVAC vane could be modeled. Through the use of the AVM program, then, 22 design variations and materials substitutions were set up and analyzed by means of NASTRAN. Specifically the analysis involved 10 runs in which 9 advanced composite layups were compared against the baseline ROVAC vane. Following this survey the ROVAC vane axles (FDL-1 design) and vane axles and boots (FDL-2 design) were removed for further design improvements. Overall, the results of the study were very positive. Bearing loads were reduced from 975 lbs to 801 and 676 lbs for the FDL-1 and FDL-2 designs, respectively. They were then further reduced to 328 lbs by thinning the vane down to 40% of its original thickness. For these same design changes, vane-tip deflections were reduced from 2.91 mils to .11 and 1.06 mils for the FDL-1 and FDL-2 carbon graphite designs, respectively. They were further reduced to .9 mils for the 40% thick design. In regard to actual vane weight the following improvements were noted: Basic ROVAC Vane = .942 lbs, FDL-1 - .772 lbs, FDL-2 = .608 lbs, and the DFL-2 (40% thick) = .323 lbs. In addition to the above, overall vane stresses were also reduced by 40% to 60% and vane-edge deflections were reduced by 70%. GRA

N78-13450# International Nickel Co., Inc., New York.
AUSTENITIC ELECTRODES FOR UNDERWATER WET WELDING Final Report
E. P. Sadowski Jun. 1977 55 p refs
(Contract N68305-77-C-0013)
(AD-A045583; CEL-CR-77-020) Avail: NTIS HC A04/MF A01 CSCL 11/6

Twelve austenitic electrodes were evaluated for use as wet welding electrodes. The type electrodes investigated were: Inco-Weld A and two modifications, INCONEL Welding Electrodes 112 and 182 and a semi-commercial stainless electrode designated R-142 and five modifications. E6013 was used as a standard. The welds were bead-on-plate and three bead multipass deposits. Most welds were made automatically in 3-1/2% NaCl solution with gravity fed electrodes and controlled travel speed. Direct current, straight polarity and the drag technique were used. The evaluation was based on operability, porosity, crack resistance and undercut. The factors considered for operability were bead appearance, slag removal, arc stability and ease of operation. The effect of travel speed, current and coating thickness on bead appearance and porosity were determined. The coating thickness was also related to depth of cup. GRA

N78-13451# Texas A&M Research Foundation, College Station.
TIRE-PAVEMENT INTERFACE VARIABILITY, VOLUME 1. SUMMARY REPORT Final Report, Jul. 1975 - Feb. 1977
Gordon G. Hayes Aug. 1977 23 p refs
(Contract DOT-HS-5-01190)
(PB-271735/3; RF3256; DOT-HS-802-553) Avail: NTIS HC A02/MF A01 CSCL 13F

To account for or eliminate the effects of surface properties on vehicle handling performance measured in established open-loop tests, various measures of surface properties were compared to vehicle test results on disparate surfaces. None of the nonvehicle textural and friction measures correlated well with vehicle performance. However, the vehicle performance was relatively insensitive to pavement properties on dry, stable surfaces. The peak coefficient of friction with partial braking using a tire tester was also insensitive to pavement differences. GRA

N78-13452# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY ON STAGE OF CENTRIFUGAL COMPRESSOR WITH AIR TURBINE
R. A. Yanson 4 May 1977 17 p Transl. into Mashinostroyeniye (USSR), no. 7, 1966 p 91-95
(AD-A045436; FTD-ID(RS)I-0759-77) Avail: NTIS HC A02/MF A01 CSCL 20/8

Discussed briefly in this article is the scheme of a centrifugal compressor with an air turbine, which replaces the bladed diffuser. A brief description is given of the experimental device and the experimental characteristics of this stage. Investigated is the problem of optimizing parameters in the given compressor.
Author (GRA)

N78-13453# Minnesota Univ., Minneapolis. Heat Transfer Lab.
HEAT TRANSFER PROBLEMS IN ADVANCED GAS TURBINES FOR NAVAL APPLICATIONS Annual Progress Report, 1 Sep. 1976 - 31 Aug. 1977
E. R. G. Eckert, R. J. Goldstein, and E. M. Sparrow 30 Aug. 1977 24 p
(Contract N00014-76-C-0246)
(AD-A045407) Avail: NTIS CSCL 13/1

The report covers heat exchanger studies stressing measurements of local heat transfer coefficients by a method based on the heat and mass transfer analogy. Local ablation rates are obtained on a model covered with napthalene and from these heat transfer rates are deduced through the analogy. Impingement cooling and porous wall heat transfer have also been investigated. A number of studies in film cooling were also completed: Experiments covered measurements in a cascade, effects of free stream conditions and of laminar boundary layer. A laser-Doppler setup was used to measure local and instantaneous velocities at the exit cross-section of a gas turbine combustor and turbulence intensities were derived. Author (GRA)

N78-13454# Sandia Labs., Albuquerque, N. Mex.
HOT-WIRE MEASUREMENTS OF THE TURBULENCE STRUCTURE IN A MOTORED SPARK-IGNITION ENGINE
P. O. Witze May 1977 14 p refs Supersedes SAND-75-8697
(Contract EY-76-C-04-0789)
(SAND-77-8233; SAND-75-8697) Avail: NTIS HC A02/MF A01

Statistical techniques were developed for the processing of hot wire anemometer signals digitally recorded from a motored Otto-cycle engine. Since engine flow processes are highly nonstationary, it is necessary to use ensemble averaging procedures to define both the mean flow properties and turbulence structure. Statistical definitions and experimental results were presented for the mean velocity, turbulence intensity, skewness, kurtosis, probability density distribution, autocorrelation function, one dimensional energy spectrum, and the micro integral scales of turbulence. It was shown that these turbulence quantities are statistically well behaved, such that an understanding and the eventual modeling of engine flow processes would appear to be an achievable goal. ERA

N78-13455# Chrysler Corp., Detroit, Mich.
BASELINE GAS TURBINE DEVELOPMENT PROGRAM Quarterly Progress Report
F. W. Schmidt and C. E. Wagner 31 Jan. 1977 101 p refs
(Contract EY-76-C-02-2749)
(COO-2749-17; QPR-17) Avail: NTIS HC A06/MF A01

An experimental upgraded gas turbine powered automobile which meets the 1978 Federal Emissions Standards, has significantly improved fuel economy, and is competitive in

performance, reliability, and potential manufacturing cost with the conventional piston engine powered, compact-size American automobile is described. Diagnostic testing and corrective development are included. To date, three upgraded engines were assembled and run in the test cell. Engine 2 was installed in an upgraded vehicle. Special diagnostic instrumentation was installed on Engine 3 to evaluate the compressor, turbine, and hot engine leakage. It was determined that the power deficiency was principally due to problems in the compressor and first stage turbine areas and during this quarter several corrective changes have been initiated. ERA

N78-13456# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.

FACTORS THAT EFFECT THE CALIBRATION OF TURBINES IN SINGLE-PHASE FLOW

T. C. Piper May 1977 19 p refs

(Contract EY-76-C-07-1570)

(TREE-NUREG-1082; ANCR-NUREG-1350) Avail: NTIS HC A02/MF A01

Basic turbine operation in single-phase flow is related. Causes and relative magnitudes of retarding torque are given for two sizes of turbines when used for water flow measurement. An equation for slip caused by retarding torques is given. Evaluation of turbine slip behavior at the turbine low flow region shows that bearing retarding torques, change in flow patterns, or other effects can predominate in the relatively large changes in the calibration constant that occurs there. Fluid lubricity is singled out as an important fluid property in certain types of bearings and flow. Temperature induced changes in turbine size are shown to cause calibration changes if a turbine is used at a temperature significantly different than that at which it was calibrated. ERA

N78-13457# Los Alamos Scientific Lab., N. Mex.

APPLICATIONS OF EXPLOSION-WELDED TRANSITION JOINTS

Alexis A. Popoff and Hugh Casey 1977 17 p refs Presented at the 1977 WESTEC Conf., Los Angeles, 14-17 Mar. 1977

(Contract W-7405-eng-36)

(LA-UR-77-496; Conf-770311-2) Avail: NTIS HC A02/MF A01

Explosion welding is presented as an alternate process of joining dissimilar metals. The process is compared with brazing, the most appropriate process for comparison, and the bond zone obtained through explosion welding is characterized. Several applications are described where transition joints were made from explosion-bonded dissimilar-metal combinations for subsequent assembly through fusion welding. ERA

N78-13458# Hanford Engineering Development Lab., Richland, Wash.

FATIGUE-CRACK GROWTH BEHAVIOR IN DISSIMILAR METAL WELDMENTS

L. A. James Mar. 1977 24 p refs

(Contract EY-76-14-2170)

(HEDL-TME-76-93) Avail: NTIS HC A02/MF A01

The techniques of linear-elastic fracture mechanics were used to characterize fatigue crack propagation behavior in three dissimilar metal weldments at test temperatures of 800 F (427 C) and 1000 F (538 C). The weldments studied included Inconel 718/Type 316, all using Inconel 82 as the filler metal. In general, fatigue, fatigue crack growth rates in the weldments were equal to, or less than, those observed in the base metals. Crack deviation from the expected path perpendicular to the loading axis was noted in some cases, and is discussed. ERA

N78-13459# Addis Translations International, Portola Valley, Calif.

STUDY OF STRUCTURAL PATTERNS OF ELECTROSLAG WELDED JOINTS OF 60-mm THICK STEEL PLATES OF LOW-ALLOY STEEL

F. Eichhorn, Peter Hirsch, Wilhelm-Guenther Burchard, and Fa-Shi Chen 1976 15 p refs Transl. into ENGLISH from Schweissen Shneiden (West Germany), v. 28, no. 6, 1976 p 210-214 Prepared for Battelle Pacific Northwest Labs. Sponsored by ERDA

(BNWL-tr-244) Avail: NTIS HC A02/MF A01

Results are discussed for studies by means of the optical as well as scanning and transmission electron microscopes of electroslag-welded joints (as-welded condition and postheat-treated) of 60mm thick plates of 13 MnNiMo, 5 4, 15 NiMoNb 5 and TTStE 36, fabricated with two wire electrodes and metal-powder filler. The tests were carried out with the objective of improving the structural pattern and thus the mechanical and technological properties of the seam and heat-affected zone of electroslag welded joints of low alloy steels. ERA

N78-13460# General Electric Co., Schenectady, N. Y. Gas Turbine Div.

HIGH TEMPERATURE GAS TURBINE ENGINE COMPONENT MATERIALS TESTING PROGRAM, TASK 1 Annual Report

M. B. Cutrone 30 Jan. 1977 147 p

(Contract EX-76-C-01-1765)

(FE-1765-27) Avail: NTIS HC A07/MF A01

A total of 159 hours of initial liquids tests were completed in 1976. This included 35 hours with COED fuel at alkali levels of .2 ppM Na + K and 35 hours with COED doped to 6 ppM alkali. Also completed were 89 hours of testing with nominal 150 ppM ash doped creosote fuel. This reconstructed fuel is produced by doping creosote with H-coal sludge. Initial gas tests were completed at MERC with 149 hours of firing time on Illinois No. 6 and Montana Rosebud coals. A total of 14,500 hours of screening tests have been completed. Facility modifications for confirmation tests were begun; turbine specimen design was completed. ERA

N78-13461# Battelle Columbus Labs., Ohio.

STATUS OF TITANIUM BLADING FOR LOW-PRESSURE STEAM TURBINES Final Report

R. A. Wood Feb. 1977 149 p refs Sponsored by Elec. Power Res. Inst.

(EPRI-AF-445; TPS-76-641) Avail: NTIS HC A07/MF A01

Worldwide usage of titanium blading in the low pressure steam turbine was assessed that steam turbine makers all over the world are considering the use of titanium blades, particularly for larger turbines, but also for present size turbines because of better corrosion resistance. Titanium blading appears close to being introduced into production steam turbines, particularly in Western Europe, and the blades are in standard production in the Soviet Union. In the USA, titanium blades are being evaluated for last stage and next-to-last stage rows on a limited basis, and are routinely used for closing blade applications. The data obtained provide guidance for R and D on titanium blading. A current project is evaluating the corrosion fatigue resistance of Ti6A1-4V alloy in steam. ERA

N78-13462# Los Alamos Scientific Lab., N. Mex.

EXPLOSION WELDING

A. A. Popoff 1977 27 p refs Presented at the 1977 Design Eng. Conf., Chicago, 9-10 May 1977

(Contract W-7405-eng-36)

(LA-UR-77-1030; Conf-770508-2) Avail: NTIS HC A03/MF A01

The theory of explosion metal-welding is reviewed briefly and the interdependence of significant parameters is discussed. Engineering aspects of industrial implementation of the process are discussed and a general characterization is made of dissimilar metal composites obtained through explosion welding. It is brought out that immiscible metals and two metals having a propensity to form intermetallic compounds or low-melting eutectics can be joined with as much ease as two metals that are mutually soluble; low ductility metals can also be welded using explosives. ERA

N78-13463# National Centre of Tribology, Risley (England). European Space Tribology Lab.

[ACTIVITIES OF THE EUROPEAN SPACE TRIBOLOGY LABORATORY] Progress Report, 1976

Paris ESA 1976 16 p refs

(Contract ESTEC-2584/75-MD)

(ESA-ESTL-27; ESA-CR(P)-993) Avail: NTIS HC A02/MF A01

Solar array drives built by Hawker Siddeley Dynamics and by Marconi Space and Defence Systems, the despin mechanism

built by Dornier System, and a double-gimballed momentum wheel by Teldix, were tested. Also, OTS solar array drives and the gold-plated slip ring assembly were tested. The supporting development program embraced lead film lubrication of ball bearings, ball bearing heat transfer measurements, bearings for the Spacelab Instrument Pointing System (IPS), and slip ring/brush tests. ESA

N78-13464# European Space Agency, Paris (France).
HELIOS A SOLAR PROBE - ANTENNA DESPIN DRIVE MECHANISM. BEARING CHARACTERISTICS IN THERMAL VACUUM AND DURING MISSION
Werner Kullmann, Eilhard Jantzen, and Willy Hellwig Oct. 1977 30 p refs Transl. into ENGLISH of 'Sonnensonde Helios A - Antennenentdrallmech. Verhalten der Lager im Thermalvakuum u. waehrend der Mission', DFVLR, Munich Report DLR-FB-76-70, 31 Dec. 1976 Original report in GERMAN previously announced as N77-25221 Original German report available from DFVLR, Cologne DM 15.10
(ESA-TT-400; DLR-FB-76-70) Avail: NTIS HC A03/MF A01

Tests were carried out with the antenna despin drive mechanism of the Helios solar probe to determine the effects of temperature gradients of bearings on the friction and restart characteristics. In addition, mission data of the despin mechanism of Helios A with respect to bearing temperature and friction over the complete mission time of 18 months were evaluated and discussed. ESA

N78-13465# Industrial Filter and Pump Mfg. Co., Cicero, Ill.
INNOVATIVE RINSE-AND-RECOVERY SYSTEM FOR METAL FINISHING PROCESSES Final Report
Walter C. Trnka and Charles J. Novotny May 1977 34 p
(Grant EPA-R-803723-01)
(PB-271298/2; EPA-600/2-77-099) Avail: NTIS HC A03/MF A01 CSCL 11F

The feasibility of a rinse-and-recovery system that can be installed in almost any metal finishing line and does not harm the environment because no plating solution exits to the sewer is described. Most toxic pollutants from metal finishing operations are associated with the water used to rinse the affected parts successive finishing operations. A typical car bumper plating operation was chosen as opposed to a barrel rolling operation. A conventional multistage aqueous rinsing system is replaced by a two stage solvent spray rinse followed by a single stage aqueous immersion rinse. By continuously purifying and recycling the baths, appreciable savings in operating chemical costs can be realized. GRA

N78-13466# Michigan Univ., Ann Arbor. Highway Safety Research Inst.
MODULAR PROGRAM DEVELOPMENT FOR VEHICLE CRASH SIMULATION. VOLUME 1: SUMMARY REPORT, TEST RESULTS AND THEORY Final Report, Mar. 1974 - Nov. 1976
I. K. McIvor, W. J. Anderson, and A. S. Wineman Aug. 1977 136 p ref 2 Vol.
(Contract DOT-HS-4-00855)
(PB-272044/9; UM-HSRI-76-4-1; DOT-HS-802-530) Avail: NTIS HC A07/MF A01 CSCL 13F

The objective of the project was to develop a computer simulation for vehicle structures under general crash conditions. The program has a user-oriented modular structure designed for maximum flexibility in the synthesis of vehicle models. Recommendations are made for future development of vehicle simulations; A description of the general program structure, modeling capability, and solution procedure for the simulation program UMVCS-1; The experimental and predicted results for static and dynamic validation tests; A modeling study of an actual vehicle dynamic frame test; The analytical studies on which the modeling elements of UMVCS-1 are based. GRA

N78-13467# Michigan Univ., Ann Arbor. Highway Safety Research Inst.
MODULAR PROGRAM DEVELOPMENT FOR VEHICLE CRASH SIMULATION. VOLUME 2: PLASTIC HINGE EXPERIMENTS Final Report, Mar. 1974 - Nov. 1976
W. J. Anderson, I. K. McIvor, and B. S. Kimball Aug. 1977 186 p 2 Vol.
(Contract DOT-HS-4-00855)
(PB-272045/6; UM-HSRI-76-4-2; DOT-HS-802-531) Avail: NTIS HC A09/MF A01 CSCL 13F

A large number of full-scale automotive box and channel beams were tested to observe the formation of plastic hinges. The purpose of the testing was to establish a data bank for moment-angle and force-extension properties of various hinges as a basis for computer simulation of crushing of automobile frames. Some 88 tests were made for extensional, bending and torsional hinges in thin walled tubes. Results are in the form of figures of the load-deflection relationship and tables of parameters used to model the hinge behavior through analytical expressions. In addition, several buckling and combined-load tests were carried out to verify the theory and the computer code which were developed concurrently. GRA

N78-13468# Forging Industry Educational and Research Foundation, Cleveland, Ohio.
EVALUATION OF DIE FORGING OF DUCTILE CAST IRON Final Report
J. W. Spretnak (Ohio State Univ., Columbus), D. E. Tilton (Columbus Forge and Iron Co.), S. Eliot (Columbus Forge and Iron Co.), S. J. Kiefer, and R. T. Herdegen, Jr. Jun. 1977 67 p refs
(Contract DI-BM-HO-262027)
(PB-271791/6; BM-OFR-131-77) Avail: NTIS HC A04/MF A01 CSCL 13H

The forgeability of ductile cast iron in the 1,700 to 1,950 range is described. It was found that while scaling is minimal, ductile iron is less plastic and requires more time and force for a given reduction than does steel forged at the same temperature. Forgeability can be improved by lower silicon content, control of flash dimensions, and the use of cast preforms. Recommendations and conclusions are given concerning the utility of forging selected articles from ductile iron castings. GRA

N78-13242*# Energy Research and Development Administration, Pittsburgh, Pa. Energy Research Center.
EXPERIENCE IN FEEDING COAL INTO A LIQUEFACTION PROCESS DEVELOPMENT UNIT
S. Akhtar, S. Friedman, N. J. Mazzocco, and P. M. Yavorsky *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 41-54 refs (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

N78-13243*# Petrocarb, Inc., N. Y.
THE PETROCARB PNEUMATIC FEEDING SYSTEM: A PROVEN METHOD FOR FEEDING PARTICULATE SOLIDS AT CONTROLLED RATES
H. Reintjes *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 55-63 refs (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

N78-13244*# Energy Research and Development Administration, Pittsburgh, Pa. Synthane Pilot Plant.
COAL PRESSURIZATION AND FEEDING: USE OF A LOCK HOPPER SYSTEM
R. Lewis, R. R. Santore, and D. Dubis *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 65-72 (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

N78-13245*# Beaumont Birch Co., Pittsburgh, Pa.
COAL GASIFICATION: NEW CHALLENGE FOR THE BEAUMONT ROTARY FEEDER
J. Stelian *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 73-99 (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

N78-13246*# Energy Research and Development Administration, Morgantown, W. Va. Energy Research Center.
DEVELOPMENT OF COAL-FEEDING SYSTEMS AT THE MORGANTOWN ENERGY RESEARCH CENTER
J. M. Hobday *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 101-133 refs (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

N78-13247*# Kamyr, Inc., Glen Falls, N. Y.
COMPARATIVE DESCRIPTION OF COAL FEEDING SYSTEMS FOR FIXED BED PRESSURE GASIFICATION
E. Funk and R. Reimert (Lurgi Mineraloltechnik GmbH, Frankfurt, West Germany) *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 134-163 (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

N78-13248*# Institute of Gas Technology, Chicago, Ill.
SLURRY PUMPING TECHNIQUES FOR FEEDING HIGH-PRESSURE COAL GASIFICATION REACTORS
W. G. Bair and P. B. Tarman *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 165-181 Sponsored by ERDA (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

N78-13249*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Palo Alto Research Lab.
DEVELOPMENT OF DRY COAL FEEDERS
J. H. Bonin, D. E. Cantey, A. D. Daniel, Jr., and J. W. Meyer *In* JPL Proc. of the Conf. on Coal Feeding Systems, 15 Sep. 1977 p 195-239 refs (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

N78-13250*# Ingersoll-Rand Research, Inc., Princeton, N. J.
DRY COAL FEEDER DEVELOPMENT PROGRAM AT INGERSOLL-RAND RESEARCH, INCORPORATED
D. K. Mistry and T. N. Chen *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 240-284 (For availability see N78-13241 04-31)
(Contract EX-76-C-01-1794)
Avail: NTIS HC A99/MF A01 CSCL 13I

N78-13251*# Foster-Miller Associates, Inc., Waltham, Mass.
FOSTER-MILLER'S DEVELOPMENT OF DRY COAL FEED SYSTEMS
J. C. Harding *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 285-323 refs (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

N78-13252*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EVALUATION OF ERDA-SPONSORED COAL FEED SYSTEM DEVELOPMENT
R. L. Phen, W. K. Luckow, L. Mattson, D. Otth, and P. Tsou *In its* Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 324-355 (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

N78-13253*# GARD, Inc., Niles, Ill.
CONTINUOUS HIGH PRESSURE LUMP COAL FEEDER DESIGN STUDY
S. F. Fields *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 359-387 refs (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

N78-13254*# Babcock and Wilcox Co., Barberton, Ohio. Power Generation Group.
BABCOCK AND WILCOX'S EXPERIENCE WITH TWO-PHASE FLOW MIXTURES OF COAL AND GAS
A. G. Bolumen *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 389-410 (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

N78-13255*# General Electric Co., Schenectady, N. Y.
PRESSURIZED FEEDING ON THE GEGAS SYSTEM
A. H. Furman *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 411-450 refs (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

N78-13256*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COAL EXTRUSION IN THE PLASTIC STATE
C. England and P. R. Ryason *In its* Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 451-465 refs (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

N78-13257*# Battelle Columbus Labs., Ohio.
A NOVEL DRY COAL FEEDING CONCEPT FOR HIGH-PRESSURE GASIFIERS
H. E. Trumbull and H. C. Davis *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 466-479 (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

N78-13258*# Solids Flow Control Corp., West Caldwell, N. J.
FEEDING THE FEEDER
A. L. Kurylchek *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 480-491 (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

N78-13259*# Mardin Engineering Co., Neponset, Ill.
EVACUATION OF COAL FROM HOPPERS/SILOS WITH LOW PRESSURE PNEUMATIC BLASTING SYSTEMS
John S. Fischer *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 493-516 (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

N78-13261*# Energy Research and Development Administration, Morgantown, W. Va. Energy Research Center.
HIGH PRESSURE ROTARY PISTON COAL FEEDER
J. F. Gardner, H. T. Gencsoy (West Virginia Univ., Morgantown), and D. C. Strimbeck *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 537-549 (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

N78-13263*# Jenike and Johnson, Inc., Billerica, Mass.
STORAGE AND FEEDING OF COAL
A. W. Jenike and J. W. Carson *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 571-585 refs (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

N78-13264*# Bechtel Corp., San Francisco, Calif.
INJECTION OF COAL BY SCREW FEED
R. Fisher *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 586-603 ref (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 10B

N78-13265*# Mitre Corp., McLean, Va. Metrek Div.
MATERIAL HANDLING SYSTEMS FOR THE FLUIDIZED-BED COMBUSTION BOILER AT RIVESVILLE, WEST VIRGINIA
J. G. Branam and W. W. Rosborough *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 604-623 (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

N78-13266*# Rockwell International Corp., Canoga Park, Calif.
ROCKETDYNE'S ADVANCED COAL SLURRY PUMPING PROGRAM
D. E. Davis, G. S. Wong, and H. H. Gilman (EPRI, Palo Alto, Calif.) *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 624-635 refs (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

N78-13267*# Acton Corp., Cleveland, Ohio.
ACTON MASS FLOW SYSTEM APPLIED TO PFBC FEED
E. Homburg *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 636-652 (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

N78-13268*# Ducon Co., Inc., King of Prussia, Pa. Ducon Fluid Transport Div.
SOME DEVELOPMENTS IN THE FEEDING OF COAL TO FLUIDIZED BED COMBUSTORS

L. G. Caldwell *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 653-674 (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

N78-13269*# Werner and Pfleiderer Corp., Waldwick, N.J.
THE USE OF TWIN SCREW EXTRUDERS FOR FEEDING COAL AGAINST PRESSURES OF UP TO 1500 PSI
W. Wiedmann and W. A. Mack (Wiedmann and Pfleiderer, Stuttgart, West Germany) *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 689-701 (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

N78-13270*# Rockwell International Corp., Pittsburg, Pa. Flow Control Div.
LOCK HOPPER VALVES FOR COAL GASIFICATION PLANT SERVICE
E. Frederick Schoeneweis *In* JPL Proc. of The Conf. on Coal Feeding Systems 15 Sep. 1977 p 702-709 (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 13I

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N78-13469 Vanderbilt Univ., Nashville, Tenn.
RELIABILITY OF FLAW DETECTION BY NONDESTRUCTIVE INSPECTION AND ITS APPLICATION TO FRACTURE MECHANICS DESIGN AND LIFE ANALYSIS Ph.D. Thesis
Jugal Kishore Malpani 1976 120 p
Avail: Univ. Microfilms Order No. 77-16079

An analysis of the reliability of flaw detection by nondestructive inspection was developed using statistical and probabilistic approaches. The probability of flaw detection at a given confidence level has been defined and evaluated for several nondestructive inspection techniques using the binomial distribution function and other related approximate distribution functions. The significance of the probability of detection values for different sampling procedures was examined. An analysis has been made to deal with false or error calls associated with nondestructive inspection. For this analysis, the Bayesian statistical approach was used to develop conditional probabilities, which have been evaluated in terms of a material-quality index, an error-probability ratio and a success-probability ratio. Probability of detection/flaw-size/probability of confidence curves have been developed for use in fracture mechanics design and life analysis. Dissert. Abstr.

N78-13470# Stanford Univ., Calif. Dept. of Operations Research.
A SYMPTOTIC FAILURE DISTRIBUTIONS
Gary Gottlieb 27 Jun. 1977 49 p refs
(Contract N00014-75-C-0561; NR Proj. 042-002)
(AD-A044894; SU-TR-182) Avail: NTIS HC A03/MF A01 CSCL 14/4

This paper considers a single device shock model. The device is subject to shocks which can cause it to fail. It is assumed that the device will almost certainly survive a large number of shocks. Then the asymptotic form of the time to failure distribution of the shock model is found under weak assumptions on the shocking process. Specifically, conditions under which the time to failure distribution is approximately Increasing Failure Rate are found. GRA

N78-13471# Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
CONDENSED OPERATING MANUAL FOR NARF SAMPLING SYSTEM
Richard S. Leavenworth, Zoran Lekic, and Henri Lorberbaum Aug. 1977 43 p
(Contracts N00014-68-A-0173-0021; N00014-75-C-0783)
(AD-A045110; RR-77-8) Avail: NTIS HC A03/MF A01 CSCL 05/1

This report contains an abbreviated set of plans and procedures from 'Procedure for Maintenance and Rework Process Quality Control Based on Random Sampling'. It is intended as a shop floor operating manual for quality assurance inspection personnel. Procedures have been abbreviated from the above mentioned source document. This report is intended to supplement the source document, not to replace it. GRA

N78-13472# Michigan Univ., Ann Arbor.
IMPROVED ULTRASONIC NONDESTRUCTIVE TESTING OF PRESSURE VESSELS Annual Progress Report, 1 Aug. 1975 - 31 Jul. 1976
J. R. Frederick, R. C. Fairchild, and B. H. Anderson Aug. 1977 137 p
(Contract AT(49-24)-0182)
(PB-271983/9; NUREG-0007-2) Avail: NTIS HC A07/MF A01 CSCL 14B

A synthetic aperture focussing technique for ultrasonic testing (SAFT UT) is described. The technique employs a single scanned transducer operating in pulse-echo mode with digital data acquisition and synthetic aperture post-processing to provide high lateral and longitudinal resolution. The extension of previously developed algorithms to provide volumetric processing and display is described. The design of a refreshed grey-scale display to provide interactive display of SAFT UT data is described. GRA

N78-13473# Oak Ridge Y-12 Plant, Tenn.
ACOUSTIC FLAW TRIANGULATION ON A THIN SPHERICAL SHELL: AN ANALYTICAL SOLUTION
H. W. Blake and C. M. Davenport 30 Dec. 1971 35 p refs
(Contract W-7405-eng-26)
(Y-1806) Avail: NTIS HC A03/MF A01

An analytical solution for acoustic flaw triangulation on thin spherical shells is presented. A FORTRAN program is provided which takes as input the differences in the arrival times of acoustic energy at the transducers and evaluates the spherical coordinates of the flaw. Only three experimental time differences need be measured. For this measurement, four transducers are required. One transducer is placed at (R, 0, 0) in spherical coordinates; the other three are spaced at 90 degrees apart around the equator. ERA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N78-13474 New Mexico Univ., Albuquerque.
HIGH TENSION ANNULAR PLATE SUBJECTED TO SMALL LATERAL LOADING Ph.D. Thesis
Chih-Cheng Ma 1976 103 p
Avail: Univ. Microfilms Order No. 77-16106

A brief survey of theories of plate is given, which emphasizes on different mathematical models of plate and various methods of solution for boundary value problems. For a combined lateral and in-plane loading problem, it is necessary to apply a non-linear plate theory. Kirchhoff's postulations lead to Karman-St. Venants equations which can not satisfy all boundary conditions on the boundary. The three dimensional theory would have satisfied the boundary conditions but leads to a complicated solution thus not easily applicable. So the decision is to choose some compromise that would satisfy boundary condition and also reasonably not too complicated a solution. the above considerations lead to the proposal that the plate is divided into a boundary layer region and the general off boundary (outer) region.
Dissert. Abstr.

N78-13475 Illinois Inst. of Tech., Chicago.
NUMERICAL INTEGRATION OF LARGE DEFLECTION ELASTIC-PLASTIC AXISYMMETRIC SHELLS OF REVOLUTION Ph.D. Thesis
Habib Uddin Ahmed 1976 174 p

Avail: Univ. Microfilms Order No. 77-13740

The improvement in the method of large deflection elastic-plastic analysis of shells and other structures appears to have continued interest. With the development in this work an improved numerical suppression scheme is now available for the large deflection elastic-plastic analysis of axisymmetric shells of revolution subjected to symmetric loadings. Quazilinearization of Sander's non-linear shell equations is presented for the first time. With these quazilinearized equations the suppression scheme has been developed to solve non-linear boundary-value problems. This suppression scheme has been used in conjunction with a Newton-Raphson method to improve a stable convergence process at the yield surface in elastic-plastic problems. Results presented indicate the accuracy of this numerical scheme. It appears to be possible to extend this method for more complicated situations. Dissert. Abstr.

N78-13476*# Kansas Univ., Lawrence. Center for Research.
STRUCTURAL ANALYSIS OF ULTRA-HIGH SPEED AIRCRAFT STRUCTURAL COMPONENTS Final Report
Kenneth H. Lenzen and William H. Siegel Dec. 1977 148 p refs
(Contract NsG-4006)
(NASA-CR-155334) Avail: NTIS HC A07/MF A01 CSCL 20K

The buckling characteristics of a hypersonic beaded skin panel were investigated under pure compression with boundary conditions similar to those found in a wing mounted condition. The primary phases of analysis reported include: (1) experimental testing of the panel to failure; (2) finite element structural analysis of the beaded panel with the computer program NASTRAN; and (3) summary of the semiclassical buckling equations for the beaded panel under purely compressive loads. A comparison of each of the analysis methods is also included. Author

N78-13477*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN INTEGRATED THEORY FOR PREDICTING THE HYDROTHERMOMECHANICAL RESPONSE OF ADVANCED COMPOSITE STRUCTURAL COMPONENTS
C. C. Chamis, R. F. Lark, and J. H. Sinclair 1977 43 p refs Presented at Tech. Specialists Conf. on Environ. Effects on Advanced Composite Mater., Dayton, Ohio, 29-30 Sep. 1977; sponsored by Am. Soc. for Testing and Mater.
(NASA-TM-73812; E-9372) Avail: NTIS HC A03/MF A01 CSCL 20K

An integrated theory is developed for predicting the hydrothermomechanical (HDTM) response of fiber composite components. The integrated theory is based on a combined theoretical and experimental investigation. In addition to predicting the HDTM response of components, the theory is structured to assess the combined hydrothermal effects on the mechanical properties of unidirectional composites loaded along the material axis and off-axis, and those of angleplied laminates. The theory developed predicts values which are in good agreement with measured data at the micromechanics, macromechanics, laminate analysis and structural analysis levels. Author

N78-13478*# Lockheed-California Co., Burbank.
REAL-TIME TESTING OF TITANIUM SHEET AND EXTRUSION COUPON SPECIMENS SUBJECTED TO MACH 2.7 SUPERSONIC CRUISE AIRCRAFT WING STRESSES AND TEMPERATURES Final Report, 1964 - 1976
Tjerand Lunde Dec. 1977 102 p refs
(Contract NAS1-13649)
(NASA-CR-2754; LR-27797) Avail: NTIS HC A06/MF A01 CSCL 20K

The accuracy of three accelerated flight-by-flight test methods for material selection, and fatigue substantiation of supersonic cruise aircraft structure was studied. The real time stresses and temperatures applied to the specimens were representative of the service conditions in the lower surface of a Mach 2.7 supersonic cruise aircraft wing root structure. Each real time flight lasted about 65 minutes, including about one hour at (500 F) in the cruise condition. Center notched coupon specimens from six titanium materials were tested: mill-annealed, duplex-annealed, and triplex-annealed Ti-8Al-1Mo-1V sheets; mill-annealed Ti-8Al-1Mo-1V extrusion; mill-annealed Ti-6Al-4V sheet; and solution-treated and aged Ti-6Al-4V extrusion. For duplex-annealed Ti-8Al-1Mo-1V sheet, specimens with single spotweld were also tested. The test results were studied in conjunction with other related data from the literature for: material selection, structural fabrication, fatigue resistance of supersonic cruise aircraft structure, and fatigue test acceleration procedures for supersonic cruise aircraft. Author

N78-13479# Lockheed Missiles and Space Co., Palo Alto, Calif.
VARIATIONAL PRINCIPLE FOR COUPLED DYNAMIC PROBLEMS OF LINEAR VISCOELASTICITY
V. G. Karnaukhov and I. K. Senchenkov 1977 5 p refs Transl. into ENGLISH from Prikl. Mekh. (USSR), v. 13, no. 8, 1977 p 113-117
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

A variational principle for the coupled problem of linear thermodiscoelasticity is formulated on the basis of the elastic-viscoelastic analogy. The introduction of certain assumptions of thermodynamic nature permits proof of the minimality property for the functional obtained in the space of Laplace-transformed variable fields. The result generalizes the minumum principle of the transformed energy for dynamical problems of elasticity theory to linear coupled thermoviscoelasticity. Author

N78-13480# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Concrete, Lab.
STUDY OF VIBRATION IN CONCRETE, REPORT 3. MECHANICS OF MOTION OF FRESH CONCRETE
A. Michel Alexander Sep. 1977 59 p refs
(AD-A045158; AEWES-TR-6-780-3) Avail: NTIS HC A04/MF A01 CSCL 11/2

Mechanical impedance tests on fresh concrete revealed the properties that resist motion. It was found that there were two distinct mechanical impedance curves depending on whether the dynamic stress applied was above or below a threshold level. At low stress levels, the impedance of the mixture was almost flat, possessing high damping, stiffness, and mass characteristics. No resonant frequency was found, but on the contrary, a wide spectrum of frequencies would produce sufficient motion for consolidation. It is likely that fresh concrete requires a continuous spectrum of energy over a wide frequency range to produce consolidation rather than discrete or optimum frequencies. Since concrete has a continuous spectrum of particle dimensions, it is probable that vibrators should supply energy over a spectrum of frequencies. Tests are planned to study the consolidation of concrete with impulses rather than a sinusoidal motion as impulses contain energy over a wide band of frequencies. GRA

N78-13481# Southwest Research Inst., San Antonio, Tex.
ADVANCED SIGNAL ANALYSIS AND INSTRUMENTATION FOR BARKHAUSEN STRESS MEASUREMENT IN STEELS Final Report, 15 Dec. 1975 - 28 Oct. 1977
G. A. Matzkanin and G. L. Burkhardt Sep. 1977 54 p refs
(Contract DAAG46-76-C-0028)
(AD-A045826; SwRI-15-4437; AMMRC-CTR-77-22) Avail: NTIS HC A04/MF A01 CSCL 11/6

Advanced methods of signal analyses were investigated as a means of improving instrumentation for Barkhausen noise stress measurement. Methods employed included pulse-sorting and pulse-counting, correlation and probability measurements, and spectrum analysis. Specimens of AISI 4340 steel and AISI 4130 steel were studied. It was found that the Barkhausen noise auto-correlation function, amplitude probability distribution, and amplitude probability density correspond closely to the comparable functions obtained from random noise. These statistical functions were found to be independent of magnetization rate and probe liftoff but slightly dependent on stress. Cursory experiments indicated that reducing the detector bandwidth may provide a means of increasing the stress sensitivity of these parameters. GRA

N78-13482# Army Materials and Mechanics Research Center, Watertown, Mass.
CASE STUDIES IN FRACTURE MECHANICS Final Report
Thomas P. Rich and David J. Cartwright Jun. 1977 475 p refs

(AD-A045877; AMMRC-MS-77-5) Avail: NTIS HC A20/MF A01 CSCL 20/11

A collection of more than thirty case studies is presented covering a wide range of practical engineering applications of fracture mechanics to design, inspection, maintenance, and failure analysis. The case studies are written by individual specialists within industry, government, and academia from the United States and Great Britain. The collection is divided into five sections corresponding to (1) Aerospace, (2) Joints and Mountings, (3) Pressure Vessels and Rotating Machinery, (4) Surface Vehicles, and (5) Materials. Most of the case studies are between twelve and fifteen pages in length and written to a standard format. The interdisciplinary nature of fracture applications is reflected in the case studies, and the reader is brought through a sequential development and solution of actual engineering problems in an interesting and economical manner.

Author (GRA)

N78-13483# Ballistic Research Labs., Aberdeen Proving Ground, Md.

CRITICAL GROWTH STRESS FOR SPALLATION

Gerald L. Moss Sep. 1977 26 p refs

(AD-A045413; BRL-2013) Avail: NTIS HC A03/MF A01 CSCL 20/8

The slip line field analysis of ductile void development is applied to the problem of fracture with stress waves, i.e., spallation, and an expression is developed for the prediction of the critical growth stress sigma go of voids in an elastic-plastic material. Comparison of experimentally measured values of sigma go with predictions based on the initial state of the material indicates it is important to account for the change in yield point of the material caused by the shock compression of the stress wave that eventually causes fracture. Application of standard yield point measurements of preshocked samples reveals that recovery processes can be important. If the critical void growth stress is expressed in terms of the shock compression effects prior to spallation, it does not appear to be a constant characteristic of the material since the shock effects are reflected in the result. The formulation presented describes shock effects and explicitly states how sigma go should depend on the extent of prior plastic strain, the plastic strain rate of this compression and recovery prior to and during the spallation process. Author (GRA)

N78-13484# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.

CREEP OF CIRCULAR PLATES USING A STATE-VARIABLE APPROACH

Y. C. Waung and R. H. Lance Aug. 1976 42 p refs

(Contract EY-76-S-02-2733)

(COO-2733-7) Avail: NTIS HC A03/MF A01

The technical theory of bending of circular plates under axisymmetric lateral loads is formulated in terms of Hart's state variable equations. Then the method is applied to plates with simply supported and clamped edges through a standard algorithm. The influence of the state variable called hardness is clearly demonstrated. Thus the analysis and the results provide a basis for acceptance of the model applied to structural components in a multiaxial state of stress. ERA

N78-13485# Hanford Engineering Development Lab., Richland, Wash.

EFFECT OF TEMPERATURE UPON THE FATIGUE-CRACK PROPAGATION BEHAVIOR OF INCONEL 625

L. A. James Mar. 1977 26 p refs

(Contract EY-76-C-14-2170)

(HEDL-TME-77-2) Avail: NTIS HC A03/MF A01

The techniques of linear-elastic fracture mechanics were employed to characterize the effect of temperature upon the fatigue crack propagation behavior of mill-annealed Inconel 625 in an air environment over the range 75 - 1200 F. In general, fatigue crack growth rates increased with increasing test temperature. Two different specimen sizes were employed at each test temperature, and no effects of specimen size upon crack growth were noted. ERA

N78-13486# Brookhaven National Lab., Upton, N. Y.

USER'S MANUAL FOR PREPROCESSOR COMPUTER PROGRAMS FOR PREPARING INPUT DATA FOR THE FINITE ELEMENT STRUCTURAL ANALYSIS PROGRAM SAPIV (PROGRAMS SPREP, COMBINE, FINALB)

C. L. Goodzeit 1 Mar. 1977 83 p refs

(Contract EY-76-C-02-0016)

(BNL-22512) Avail: NTIS HC A04/MF A01

A finite element structural analysis program such as SAPIV can require a large amount of effort in data preparation, particularly for three-dimensional structural models and two-dimensional cases of complicated geometry. The development of a self-organizing quadrilateral mesh such as QMESH has made it possible to reduce significantly the amount of manual data preparation for SAPIV. The mesh description generated by QMESH can be transformed into appropriate card images for input to SAPIV by means of the preprocessor, SPREP. Two types of element generation are available in SPREP: quadrilateral elements for two-dimensional plane or axisymmetric problems (Type 4), and 8- or 12-mode three-dimensional elements (Type 8). The Type 8 elements can be generated for the following geometrical cases: a plate, a cylindrical shell section, a spherical shell section, or a toroidal shell section. SPREP can be readily modified by the user to include additional features that are desired. The program produces the bulk of the input data for SAPIV, which includes the nodal point coordinate card images and the element numbering card images. ERA

N78-13487# Heat Transfer Research, Inc., Alhambra, Calif.

FLOW-INDUCED TUBE VIBRATIONS IN SHELL-AND-TUBE HEAT EXCHANGERS Final Report, 1 Jun. 1976 - 28 Feb. 1977

J. M. Chenoweth Feb. 1977 166 p refs

(Contract EY-76-C-03-1273)

(SAN-1273-1) Avail: NTIS HC A08/MF A01

The results of the presentations and discussions among the the fourteen invited panelists and the audience are summarized. Areas for both short term and long term research were identified and recommendations made. Prepared statements by each of the panelists, statements by others, a background technical report, a bibliography, and a list of workshop attendees are included as appendices. ERA

N78-13488# Failure Analysis Associates, Palo Alto, Calif.

INFLUENCE FUNCTION METHOD FOR FRACTURE MECHANICS AND RESIDUAL FATIGUE LIFE ANALYSIS OF CRACKED COMPONENTS UNDER COMPLEX STRESS FIELDS

P. M. Besuner Jul. 1975 87 p refs

(EPRI-217-1; TR-2) Avail: NTIS HC A05/MF A01

The development and application of an influence function method for calculating stress intensity factors and residual fatigue life for two- and three-dimensional structures with complex stress fields and geometries are reviewed. Through elastic superposition, the method properly accounts for redistribution of stress as the crack grows through the structure. The analytical methods utilized and the computer programs necessary for computation and application of load independent influence functions (IF) are presented. A new exact solution is obtained for the buried elliptical crack, under an arbitrary Mode 1 stress field for stress intensity factors at four positions around the crack front. The IF method is then applied to two fracture mechanics problems with complex stress fields and geometries. These problems include the fatigue analysis of a crack in a pipe weld under nominal and residual stresses and fatigue analysis of a reactor vessel nozzle corner crack under a complex bivariate stress field. ERA

N78-13489# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.

A NEW DESIGN FORMULA FOR CHAIN LINKS

G. T. Anthony, T. A. E. Gorley, and J. G. Hayes Apr. 1977 59 p refs

(NPL-NAC-79; Avail: NTIS HC A04/MF A01

The stress analysis of chain links was used to obtain data for a range of shapes and sizes of the link. Design formulas were devised which fit these data to a specified accuracy. ESA

N78-13490# Oxford Univ. (England). Engineering Lab.

FAILURE ANALYSIS OF PRESSURE VESSELS WITH DEFECTS Progress Report

P. H. Hodkinson May 1977 30 p refs

(OUEL-1198/77) Avail: NTIS HC A03/MF A01

The crack growth behavior of longitudinal through-thickness and part-through-thickness cracks in model cylindrical vessels of polycarbonate plastic was studied. Results for those models failing by an unstable brittle fracture mode are well explained on the basis of linear elastic fracture mechanics; however, in situations where crack stabilization occurs, limit analysis techniques give reasonable estimates of limit pressures, after due allowance is made for slow crack growth. Author (ESA)

N78-13491# Advisory Group for Aerospace Research and Development, Paris (France).

USE OF GENERAL FATIGUE DATA IN THE INTERPRETATION OF FULL-SCALE FATIGUE TESTS

W. Barrois Oct. 1977 78 p refs

(AGARD-AG-228) Avail: NTIS HC A05/MF A01

Stress concentrations due to load transfer through fasteners were investigated for the case of asymmetric single shear of the fasteners. The breakdown of the applied loadings includes the peak-to-peak, ground-air-ground variation. In load transfer by fastener bearing stresses, the low compressive loads may be neglected, the local highest stresses varying from zero to the maximum. Interpretation of full-scale fatigue results, either for a different loading or for a slightly modified local design of the structure, is essentially comparative. In order to locate the computation points within a suitable region of the curves, the stress concentration factor is multiplied by a damage adjustment factor, such that the Miner damage is 1 for the local failure of the structure considered. Author

42 GEOSCIENCES (GENERAL)

N78-13492*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ABSTRACTS FOR THE PLANETARY GEOLOGY FIELD CONFERENCE ON AEOLIAN PROCESSES

Ronald Greeley, ed. (Arizona State Univ.) and David Black, ed. Jan. 1978 63 p refs

(NASA-TM-78455; A-7279) Avail: NTIS HC A04/MF A01 CSCL 08G

The Planetary Geology Field Conference on Aeolian Processes was organized at the request of the Planetary Geology Program office of the National Aeronautics and Space Administration to bring together geologists working on aeolian problems on earth and planetologists concerned with similar problems on the planets. Abstracts of papers presented at the conference are arranged herein by alphabetical order of the senior author. Papers fall into three broad categories: (1) Viking Orbiter and Viking Lander results on aeolian processes and/or landforms on Mars, (2) laboratory results on studies of aeolian processes, and (3) photogeology and field studies of aeolian processes on Earth. Author

N78-13493# Freie Univ., Berlin (West Germany).

[RESEARCH ACTIVITIES OF THE FREE UNIVERSITY BERLIN] Annual Report, 1 Oct. 1975 - 24 Nov. 1976

1976 353 p In GERMAN

(AR-6) Avail: NTIS HC A16/MF A01

The university has a department of geosciences dealing with geology, paleontology, meteorology, geophysics (solar-terrestrial relations), and geography. ESA

N78-13494# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.

CATALOG OF GEOMAGNETIC ACTIVITY BASED ON SIX CLASS DIVISIONS, 1868 - 1976

Joseph A. Sutorik and Cheryl M. Cruickshank Jul. 1977 130 p refs

(PB-272205/6; NOAA-TM-ERL-SEL-47; NOAA-77082516) Avail: NTIS HC A07/MF A01 CSCL 04A

A homogeneous set of data describing the average daily state of the geomagnetic field is presented for the period 1868-1976. The daily values are provided in two formats: Bartels rotation (27-day) and calendar. GRA

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N78-13495 California Univ., Berkeley.

COMPONENTS OF FLOW RESISTANCE IN A NATURAL CHANNEL Ph.D. Thesis

Thomas Edwin Lisle 1976 86 p

Avail: Univ. Microfilms Order No. 77-15765

Flow resistance in a channel offered by the bed, the banks, and channel curvature were distinguished in a riffle, a pool, and two bends of the East Fork River, Wyoming. For each of these, the width, mean velocity, perimeter, hydraulic radius, and energy slope were measured during 24 moderate to above bankfull flows. It was found that whole channel resistance was greatest at the bends and least at the riffle. At high flow, values for energy slope and unit shear stress for the straight reaches were approximately equal, but less than those values for the bends. Velocity, depth, and slope adjust in differing manner so that hydraulic friction shows only slight systematic variation with discharge, decreasing with discharge at the straight reaches and increasing at the bends. Dissert. Abstr.

N78-13496 Rochester Univ., N. Y.

TIME SCALES INTRANSIENT WIND-DRIVEN LAKE CIRCULATIONS Ph.D. Thesis

Mamdouh Abdel-Hamid Fahmy Mohammed-Zaki 1977 360 p

Avail: Univ. Microfilms Order No. 77-16242

To determine the manner in which a large homogeneous lake adjusts to time variations in wind stress, the initial value problem was solved for a suddenly imposed wind stress on an initially quiescent lake. The equations for the model were those of Ekman, with the additional assumptions of a rigid lid and small vertical and horizontal Ekman numbers. The transient three dimensional currents were computed exactly for constant depth basins, and by using boundary layer techniques for variable depth basins having closed depth contours. The transient coastal flow in constant depth basins was also presented. Dissert. Abstr.

N78-13497 Pennsylvania State Univ., University Park.

A REMOTE DISPLAY SYSTEM UTILIZING COMPRESSED DATA TRANSMISSION Ph.D. Thesis

Edsel Glen Crenshaw 1977 163 p

Avail: Univ. Microfilms Order No. 77-17681

The design, implementation and evaluation of a color display system for use in image analysis is described. The system design is compatible with the satellite and aircraft image processing requirements of the Office for Remote Sensing of Earth Resources. Potential system configurations were defined and evaluated. The selected configuration consisted of a minicomputer, a modem, color television display hardware and an operator terminal. A telephone connection to an IBM 370/168 computer was used to receive images which conformed to standard remote job entry data formats. Because of the relatively slow transmission speeds possible and the large data content of the images, data compression was necessary. Dissert. Abstr.

N78-13498 Cornell Univ., Ithaca, N. Y.

ANALYTICAL AERIAL TRIANGULATION WITH CORRECTIONS FOR SYSTEMATIC ERRORS Ph.D. Thesis

Bahattin Coskun 1976 172 p

Avail: Univ. Microfilms Order No. 77-19993

It was shown that a portion of systematic image deformations can successfully be compensated for by the introduction of unknown additional parameters into the colinearity equations. A model consisting of 29 additional parameters was incorporated into the bundle adjustment. The additional parameters were treated as observations to avoid the ill conditioning of the normal equations arising from the fact that some of the parameters are correlated with one another and/or with orientation unknowns. It was not generally necessary to justify the physical meaning of each parameter, though the terms should be effective and significant in compensating for the systematic errors. The correction model incorporated a combination of the sources of systematic errors

as well as some empirical terms to account for persistent sources of systematic errors. Dissert. Abstr.

N78-13499*# Environmental Research Inst. of Michigan, Ann Arbor.

INVESTIGATIONS OF SPECTRAL SEPARABILITY OF SMALL GRAINS, EARLY SEASON WHEAT DETECTION, AND MULTICROP INVENTORY PLANNING Final Report, 15 May 1976 - 14 Nov. 1977

Richard F. Nalepka, Principal Investigator, William A. Malila, and James M. Gleason Nov. 1977 85 p refs

(Contract NAS9-14988)

(E78-10015; NASA-CR-151553; EIRM-122700-34-F) Avail: NTIS HC A05/MF A01 CSCL 02C

The author has identified the following significant results. LANDSAT data from seven 5 by 6 segments having crop type information were analyzed to determine the potential for spectral separation of spring wheat from other small grains as an alternative to the primary LACIE procedure for estimating spring wheat acreage. Within segment field-center, classification accuracies for spring wheat vs. barley tended to be best in mid-July when crop color changes were in progress. When correlations were made for differences in atmospheric haze, data from several segments could be aggregated, and results that approached within segment accuracies were obtained for selected dates. LACIE field measurement spectral reflectance data provided information on both wheat development patterns and the importance of various agronomic factors on wheat reflectance, the most important being availability of soil moisture. To investigate early season detection for winter wheat, reflectance of developing wheat patterns was simulated through reflectance modeling and was analyzed along with field measured reflectance from a Kansas site. The green component development of the wheat field was analyzed as a function of data throughout the season. A selected threshold was not crossed by all fields until mid-April. These reflectance data were shown to be consistent actual LANDSAT data.

N78-13500*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

COMPARING SOIL BOUNDARIES DELINEATED BY DIGITAL ANALYSIS OF MULTISPECTRAL SCANNER DATA FROM HIGH AND LOW SPATIAL RESOLUTION SYSTEMS

S. J. Kristof, Principal Investigator, M. F. Baumgardner, A. L. Zachary, and E. R. Stoner 1977 11 p refs EREP

(Contract NAS9-14016)

(E78-10017; NASA-CR-151530; LARS-Publ-082477) Avail: NTIS HC A02/MF A01 CSCL 08M

The author has identified the following significant results. Computer-aided analysis techniques used with aircraft MSS data showed that the spatial resolution was sufficient to recognize each soil mapping unit of the test site. Some difficulties occurred where different soil series were intricately mixed, and this mixture showed as a separate spectral mapping unit, or where the difference between two soils depended on the depth of silty surface material. Analysis of LANDSAT data with computer-aided techniques showed that it was not possible to find spectrally homogeneous soil features of the seven soil series on the 40 ha test site on the digital display or on a picture print map. Cluster techniques could be used on an extended test area to group spectrally similar data points into cluster classes.

N78-13501*# West Virginia Dept. of Natural Resources, Charleston.

CONTRIBUTIONS OF LANDSAT TO NATURAL RESOURCE PROTECTION AND FUTURE RECREATIONAL DEVELOPMENT IN THE STATE OF WEST VIRGINIA Final Report, Jun. 1975 - Oct. 1977

Ira S. Latimer, Jr. and David C. Callaghan, Principal Investigators 31 Oct. 1977 116 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS

(Contract NAS5-22327)

(E78-10019; NASA-CR-155246) Avail: NTIS HC A06/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N78-13502*# Michigan State Univ., East Lansing.

USE OF REMOTE SENSING FOR LAND USE POLICY FORMULATION Semiannual Progress Report, Dec. 1976 - May 1977

Myles Boylan, Principal Investigator 28 Aug. 1977 31 p refs ERTS

(Grant NGL-23-004-083)

(E78-10020; NASA-CR-155247) Avail: NTIS HC A03/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N78-13503*# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.

APPLICATION OF LANDSAT TO THE SURVEILLANCE OF LAKE EUTROPHICATION IN THE GREAT LAKES BASIN Final Report, Mar. 1975 - Sep. 1977

Robert H. Rogers, Vann E. Smith (Cranbrook Inst. of Science, Bloomfield Hills, Mich.), James P. Scherz (Wisconsin Univ., Madison), William J. Woelkerling (Wisconsin Univ., Madison), Michael S. Adams (Wisconsin Univ., Madison), and John E. Gannon, Principal Investigators (Michigan Univ., Pellston) Sep. 1977 193 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS

(Contract NAS5-20942)

(E78-10023; NASA-CR-154951; BSR-4291) Avail: NTIS HC A09/MF A01 CSCL 08H

The author has identified the following significant results. A step-by-step procedure for establishing and monitoring the trophic status of inland lakes with the use of LANDSAT data, surface sampling, laboratory analysis, and aerial observations were demonstrated. The biomass was related to chlorophyll-a concentrations, water clarity, and trophic state. A procedure was developed for using surface sampling, LANDSAT data, and linear regression equations to produce a color-coded image of large lakes showing the distribution and concentrations of water quality parameters, causing eutrophication as well as parameters which indicate its effects. Cover categories readily derived from LANDSAT were those for which loading rates were available and were known to have major effects on the quality and quantity of runoff and lake eutrophication. Urban, barren land, cropland, grassland, forest, wetlands, and water were included.

N78-13504*# Wisconsin Univ., Madison. Inst. for Environmental Studies.

ON MULTIDISCIPLINARY RESEARCH ON THE APPLICATION OF REMOTE SENSING TO WATER RESOURCES PROBLEMS Progress Report, 1976 - 1977

James L. Clapp 1977 384 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS

(Grant NGL-50-002-127)

(E78-10028; NASA-CR-155253) Avail: NTIS HC A17/MF A01 CSCL 08H

There are no author-identified significant results in this report.

N78-13505*# Norwegian Water Resources and Electricity Board, Oslo.

APPLICATION OF LANDSAT IMAGERY FOR SNOW MAPPING IN NORWAY Final Report

Helger Odegaard, Principal Investigator and Gunnar Ostrem 1 Feb. 1977 64 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS

(E78-10029; NASA-CR-155254) Avail: NTIS HC A04/MF A01 CSCL 08L

The author has identified the following significant results. It was shown that if the snow cover extent was determined from all four LANDSAT bands, there were significant differences in results. The MSS 4 gave the largest snow cover, but only slightly more than MSS 5, whereas MSS 6 and 7 gave the smallest snow area. A study was made to show that there was a relationship between the last date of snow fall and the area covered with snow, as determined from different bands. Imagery obtained shortly after a snow fall showed no significant difference in the snow-covered area when the four bans were compared,

whereas, pronounced differences in the snow-covered area were found in images taken after a long period without precipitation.

N78-13506*# Mississippi State Univ., Mississippi State.
APPLICATION OF REMOTE SENSING TO STATE AND REGIONAL PROBLEMS Semiannual Progress Report, 1 May - 31 Oct. 1977
W. Frank Miller, Principal Investigator, Bradley D. Carter, David E. Pettry, Gary K. Higgs, James L. Solomon, and Dale A. Quattrochi 7 Nov. 1977 92 p refs Original contains imagery. Original photography maybe purchased from the EROS Data Center, Sioux Falls, S. D. ERTS
(Grant NGL-25-001-054)
(E78-10034; NASA-CR-155261; SAPR-8) Avail: NTIS HC A05/MF A01 CSCL 08F

There are no author-identified significant results in this report.

N78-13507*# Mississippi State Univ., Mississippi State. Dept. of Geology and Geography.
TENNESSEE-TOMBIGBEE INDUSTRIAL SITING PROJECT: A STUDY OF PHYSICAL AND ENVIRONMENTAL FACTORS OF POTENTIAL INDUSTRIAL SITES
Gary K. Higgs, Principal Investigator 31 Oct. 1977 176 p refs ERTS
(Grant NGL-25-001-054)
(E78-10035; NASA-CR-155260) Avail: NTIS HC A09/MF A01 CSCL 08H

There are no author-identified significant results in this report.

N78-13508*# Stanford Univ., Calif. Dept. of Applied Earthsciences.
APPLICATION OF HCMM SATELLITE DATA TO MINERAL EXPLORATION Progress Report, 1 Jul. - 31 Oct. 1977
R. J. P. Lyon, Principal Investigator 1 Nov. 1977 5 p ERTS
(Contract NAS5-24106)
(E78-10036; NASA-CR-155258) Avail: NTIS HC A02/MF A01 CSCL 08G

There are no author-identified significant results in this report.

N78-13509*# Ecosystems International, Inc., Gambrills, Md.
APPLICATIONS OF REMOTE SENSING TO WATER RESOURCES Technical Report, 15 Mar. - 30 Apr. 1977
Dec. 1977 52 p
(Contract NAS8-32408)
(NASA-CR-150467) Avail: NTIS HC A04/MF A01 CSCL 08H

Analyses were made of selected long-term (1985 and beyond) objectives, with the intent of determining if significant data-related problems would be encountered and to develop alternative solutions to any potential problems. One long-term objective selected for analysis was Water Availability Forecasting. A brief overview was scheduled in FY-77 of the objective -- primarily a fact-finding study to allow Data Management personnel to gain adequate background information to perform subsequent data system analyses. This report, includes discussions on some of the larger problems currently encountered in water measurement, the potential users of water availability forecasts, projected demands of users, current sensing accuracies, required parameter monitoring, status of forecasting modeling, and some measurement accuracies likely to be achievable by 1980 and 1990. Author.

N78-13510*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A COST-BENEFIT EVALUATION OF THE LANDSAT FLOW-ON OPERATIONAL SYSTEM
Mar. 1977 124 p refs
(NASA-TM-78052; X-903-77-49) Avail: NTIS HC A05/MF A01 CSCL 05C

Disciplines to benefit from the LANDSAT Follow-on System include agriculture, petroleum and mineral exploration, hydrologic land use, water resources management, forestry, land use planning and monitoring, and soil management. The annual quantified benefits are in the range of 420 to 970 million (FY 1976 dollars). The operational system sized to achieve the quantified benefits involves a single orbiting satellite with a backup satellite in launch readiness. The ground system includes a basic processing system which feeds information to three user systems - one for agriculture, one for hydrologic land use, and a third for all other users. The resulting present worth benefit cost ratio is at least equal to four with a reasonable likelihood of exceeding nine. This benefit cost ratio is evaluated for an infinite time horizon at the discount rate of 10 percent. Author

N78-13511# Lockheed Missiles and Space Co., Palo Alto, Calif.
INVESTIGATION OF EARTH FROM SPACE: JOINT EXPERIMENT OF USSR AND GDR SCIENTISTS ON THE SOIUZ-22 SPACECRAFT
R. Z. Sagdeev 1977 20 p Transl. into ENGLISH from Vestn. Akad. Nauk SSSR (USSR), no. 3, 1977 p 6-20
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Methods of remote sensing used in studying the earth were reviewed. Techniques mentioned included spectrum analysis and aerial photography, with emphasis on multizonal photography. Experiments and investigations performed by Soyuz spacecraft using multizonal photography were discussed. Specific photographic systems were explained, including their orientations and operation in regard to the spacecraft, and their expected accuracies in resolution. B.L.P.

N78-13512# Louisiana State Univ., Baton Rouge.
EFFECT OF VISCOSITY RATIO ON THE RECOVERY OF FRESH WATER STORED IN SALINE AQUIFERS Final Report
O. K. Kimbler and W. R. Whitehead Apr. 1977 40 p refs
(Contract DI-14-34-0001-6019)
(PB-270780/0; W77-10264; OWRT-A-037-LA(1)) Avail: NTIS HC A03/MF A01 CSCL 08H

Differences in viscosity between injected and displaced fluids were studied as they affect recovery efficiency during underground water storage. Experimental studies suggested: (1) recovery efficiency is maximum where the viscosities are equal; (2) the recovery efficiency is approximately the same for a fixed viscosity difference irrespective of whether injected or native water is the more viscous; and (3) a computational procedure is applicable for a unity or nonunity viscosity ratio provided an effective dispersivity is used which was obtained from an injection/production well test. GRA

N78-13513# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
AERIAL PHOTOINTERPRETATION OF A SMALL ICE JAM
Stephen L. Denhartog Oct. 1977 21 p
(AD-A045870; CRREL-SR-77-32) Avail: NTIS HC A02/MF A01 CSCL 08/12

Aerial photos of a small ice jam on the Pemigewasett River near Plymouth, New Hampshire, were taken three days after the jam and compared with photos taken after the ice went out. The winter photos show a marked and sudden decrease in floe size apparently indicative of faster and longer movement of the ice. The spring photos show a number of shallows and obstructions that apparently had no effect on the ice movement. It is concluded that this jam was caused by a change in slope and subsequent reduction in velocity. Author (GRA)

N78-13514# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
UPDATED SYSTEM FOR CALCULATIONS OF COORDINATES FOR LOCATING POINTS ON COMPUTER GEO 2
W. Gedymin 12 May 1977 10 p Transl. into ENGLISH from Przeglad Geodezyjny (Poland), v. 47, no. 12, 1975 p 499-500
(AD-A045434; FTD-ID(RS)I-0667-77) Avail: NTIS MF A01 CSCL 09/2

In the majority of Geodesy Information Centers in Poland, the machine GEO 2 is a basic computer. This computer, relatively well programmed for Geodesy, is used for various typical calculations, and in particular to Geodetic workout of detailed plans for utilizing the terrain, land survey and ensuing work. Programs enabling one to carry out this type of calculations are incorporated in two systems: system PG 4, and system MAPA 1, as well as different versions of them modified by the users. GRA

N78-13515# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

EXPERIMENTAL SCALING STUDY OF AN ANNULAR FLOW ICE-WATER HEAT SINK

John M. Stubstad and William F. Quinn Jun. 1977 61 p
(AD-A045869; CRREL-77-15) Avail: NTIS HC A04/MF A01 CSCL 13/1

A laboratory experimental study was conducted on a scale model of an annular flow ice-water heat sink to be used to store the waste heat produced in a hardened defense installation operating in an isolated mode. The study examined: (1) scaling relationships for predicting the performance of prototype units using data from scale models, (2) the accuracy of a computer prediction technique developed during an earlier study, (3) the heat transfer phenomenon at the ice-water interface, and (4) some practical aspects related to the operation of a prototype installation. The scaling relationships and the computer program were found to be sufficiently accurate for use in developing a prototype sink design. During operation the scale model sink provided an almost constant low temperature source of coolant water for approximately one-half its useful life and thereafter behaved like an ordinary stored water reservoir type heat sink. No significant operational problems were discovered.
Author (GRA)

N78-13516# Army Engineer Waterways Experiment Station, Vicksburg, Miss.

ACQUISITION OF TERRAIN INFORMATION USING LANDSAT MULTISPECTRAL DATA. REPORT 2, AN INTERACTIVE PROCEDURE FOR CLASSIFYING TERRAIN TYPES BY SPECTRAL CHARACTERISTICS

Horton Struve, Warren E. Grabau, and Harold W. West Sep. 1977 142 p refs
(AD-A045871; WES-TR-M-77-2-2) Avail: NTIS HC A07/MF A01 CSCL 15/4

Developed in the study reported herein was a semiautomated procedure for classifying LANDSAT radiance data in terms of preselected land-use categories. The procedure is an interim solution to the problem of mapping very large areas in terms of relatively crude categories in very short periods of time. Operation of the procedure requires an analyst to direct a computer by means of interactive instructions to search for all the 3 by 3 pixel arrays exhibiting spectral signatures that conform to a selected criterion of homogeneity. The computer then retrieves these signatures from within the array of LANDSAT radiance values and groups them into spectrally similar clusters. The clusters are then displayed on a color coded map overlay from which the analyst must provide the final interpretation and classification. The area selected for study is centered approximately 40 km northeast of Vicksburg, Mississippi. The area includes a representative section of loess hills, forming the eastern wall of the Mississippi floodplain, and a section of the floodplain, including an oxbow lake and a number of other floodplain features.
Author (GRA)

N78-13517# Texas Instruments, Inc., Dallas.

AERIAL GAMMA-RAY AND MAGNETIC SURVEY OF THE RED RIVER AREA, BLOCK C, TEXAS AND OKLAHOMA, VOLUME 2

Mar. 1977 198 p
(Contract EY-76-C-13-1664)
(GJBX-17(77)-Vol-2) Avail: NTIS HC A09/MF A01

Aerial gamma and magnetic survey maps are presented for Block C of the Red River area of Texas and Oklahoma. Histograms of U, Th, and K deposits are included. ERA

N78-13518# Officine Galileo S.p.A., Florence (Italy). Div. Sistemi.

IRFES - INFRA-RED FAN BEAM EARTH SENSOR. PROTOTYPE MODEL Final Report

Paris ESA Nov. 1976 384 p refs
(Contract ESTEC-1799/72-AA)
(ESA-CR(P)-974) Avail: NTIS HC A17/MF A01

The design is described of the fan beam IR horizon sensor. A description is given of sensor optical head, the design and optimization of the sensor electronics, the sensor housing and tests performed. A mathematical model is used for the analysis of sensor errors. An evaluation is included of sun and moon interference on sensor operation. An error and reliability analysis is detailed. ESA

N78-13519# Swedish Space Corp., Solna.

QUICK-LOOK CAPABILITY IN A EUROPEAN EARTH RESOURCES SATELLITE DATA NETWORK, VOLUME 1 Final Report

Paris ESA 15 Apr. 1977 150 p refs Prepared jointly with Stansaab Elektronik AB 2 Vol.
(Contract ESA-SC/128-HQ)
(FU15-4-Vol-1; ESA-CR(P)-977-Vol-1) Avail: NTIS HC A07/MF A01

Plans of the European Space Agency for creation of an earth resources satellite ERS data network (Earthnet) comprising both national and European facilities are described. The network will receive, process, and distribute ERS data to a widespread group of earth scientists. Initially, the network will accept data from the American satellites in the LANDSAT series, Nimbus-G, HCMM, and SEASAT. User requirements for quick-look data in the area covered by the network were identified, and elements required for an optimum quick-look system to meet user requirements were assessed. ESA

N78-13520# Geological Survey, Raleigh, N. C. Water Resources Div.

HYDROLOGY OF THE CREEPING SWAMP WATERSHED, NORTH CAROLINA, WITH REFERENCE TO POTENTIAL EFFECTS OF STREAM CHANNELIZATION Final Report

M. D. Winner, Jr. and C. E. Simmons Apr. 1977 62 p refs Prepared in cooperation with the North Carolina Dept. of Natural and Economic Resources, Raleigh and Soil Conservation Service, Raleigh, N. C.
(PB-270926/9; USGS-WRI-77-26; USGS-WRD-WRI-77-045) Avail: NTIS HC A04/MF A01 CSCL 08H

Hydrologic data were collected for four years at six sites in the Creeping Swamp watershed in eastern North Carolina in a preliminary effort to study the effects of stream channelization on the hydrology of a small watershed. A water-budget evaluation for pre-channelized conditions showed that runoff accounts for about 17 percent of the total rainfall, base runoff about 20 percent, ground-water outflow about 2 percent, and evapotranspiration about 61 percent. Channelization would have caused the greatest decline in ground-water levels nearest the stream, with the decline diminishing with increased distance from the stream. GRA

N78-13521# Virginia Polytechnic Inst. and State Univ., Blacksburg. Water Resources Research Center.

EFFECT OF LAND USE MANAGEMENT ON FLOOD PREDICTIONS

Rod W. Smith (Central Shenendoah Planning District Commision), Donald K. Jamison (Virginia Military Inst.), and John W. Knapp (Virginia Military Inst.) Jun. 1977 46 p refs Sponsored by the Dept. of the Interior
(PB-270645/5; VPI-WRRC-Bull-103; W77-10181; OWRT-A-062-VA(3)) Avail: NTIS HC A03/MF A01 CSCL 08H

The effects of changes in land-use practices and hydrologic parameters on flooding in an urban area is investigated. Modeling techniques developed by the Soil Conservation Service to local computing facilities were adapted and these models were applied to flooding problems in the South River Watershed in and above Waynesboro, Virginia. GRA

N78-13522# Idaho Univ., Moscow. Water Resources Research Inst.

EFFECT OF ANTECEDENT ON FROZEN GROUND FLOODS

Ralph Pedersen, Myron Molnau, and En Sheng Yen (Ping Tung Inst. of Agriculture) Jan. 1977 32 p refs Sponsored by Dept. of the Interior
(PB-270632/3; W77-10175; OWRT-A-045-IDA(3)) Avail: NTIS HC A03/MF A01 CSCL 08H

Discriminant analysis is used to study frozen and unfrozen ground runoff events for four watersheds in the Pacific Northwest. Part of the discriminant procedure was used to choose a set of meteorological factors for each area that can distinquish between frozen and unfrozen ground runoff events. These variables were then used to define a system to classify other past or future

runoff events. The occurrence of a frozen ground runoff event is dependent on the combination of several meteorological factors interacting together rather than on the influence of one single variable such as the average minimum air temperature. This methodology proved successful for two of the watersheds studied. GRA

N78-13523# Central Intelligence Agency, Washington, D.C. Office of Geographic and Cartographic Research.
WORLD DATA BANK 2. GENERAL USERS GUIDE
Alexander J. Gorny Jul. 1977 11 p
(PB-271869/0; CIA/DF-77/001A) Avail: NTIS HC A02/MF A01; also available in set of 5 mag tapes and PB-271869 (documentation) CP T10, PB-271874-SET CSCL 08B

World Data Bank 2 is a digital representation of the world divided into five geographic areas. Each area is contained on a single magnetic tape; each tape contains three files of unique line segments defined by individually digitized points. The five specific tapes and associated areas are Volume 1--North America; Volume 2--South America; Volume 3--Europe; Volume 4--Africa; Volume 5--Asia. The three files contained in each volume are (1) coastlines, islands, lakes (CIL); (2) rivers (RIV); (3) international boundaries (BDY). In addition, Volume 1--North America contains a fourth file of internal boundaries (PBY) to further delineate the individual states of the USA and the provinces of Canada. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N78-13524 Florida Univ., Gainesville.
TRANSPORT PROCESSES IN TEFLON-BONDED FUEL CELL ELECTRODES Ph.D. Thesis
Myung-cheen Lee 1976 114 p
Avail: Univ. Microfilms Order No. 77-17032

The structure and properties of Teflon bonded fuel cell electrodes and their components were investigated. Experiments employing scanning electron microscopy and energy dispersive X-ray analysis indicated that the Teflon particles are prolate spheroidal aggregates of approximately spherical molecules. In a commonly used electrode composition these Teflon aggregates are coated with one or more layers of catalyst crystallites. Electrode reactions, ionic hydration, water transport, and their effects on the behavior of fuel cells were studied. It was found that hydration of potassium and hydroxyl ions causes some change in the concentration of electrolyte and its gradient in the electrolyte matrix and the electrode layer. Dissert. Abstr.

N78-13525 Columbia Univ., New York.
EFFECT OF PULSED CURRENT CHARGING ON THE PERFORMANCE OF NICKEL-CADMIUM CELLS Ph.D. Thesis
Aghavni Artun Bedrossian 1976 227 p
Avail: Univ. Microfilms Order No. 77-17639

A systematic investigation on the performance of Ni-Cd cells by pulsed current charging was conducted under a variety of well-defined charge-discharge conditions. Experiments were carried out with half cells and film electrodes. The system behavior was studied by charge acceptance, mechanistic and structural measurements. Under the experimental conditions used in this work, the reactions at the Ni-electrode can be described by a solid-state mechanism, whereas, the reactions at the Cd-electrode can be explained by a combination of solid-state and dissolution-precipitation mechanism. Dissert. Abstr.

N78-13526* National Aeronautics and Space Administration. Pasadena Office, Calif.
HIGH VOLTAGE, HIGH CURRENT SCHOTTKY BARRIER SOLAR CELL Patent
Richard J. Stirn, inventor (to NASA) (JPL) Issued 11 Oct. 1977 5 p Filed 5 Aug. 1974 Supersedes N74-30448 (12 - 20, p 2374) Sponsored by NASA
(NASA-Case-NPO-13482-1; US-Patent-4,053,918; US-Patent-Appl-SN-495021; US-Patent-Class-357-30; US-Patent-Class-357-15; US-Patent-Class-357-16; US-Patent-Class-136-89-SJ) Avail: US Patent Office CSCL 10A

A Schottky barrier solar cell was described, which consists of a layer of wide band gap semiconductor material on which a very thin film of semitransparent metal was deposited to form a Schottky barrier. The layer of the wide band gap semiconductor material is on top of a layer of narrower band gap semiconductor material, to which one of the cell's contacts may be attached directly or through a substrate. The cell's other contact is a grid structure which is deposited on the thin metal film.
Official Gazette of the U.S. Patent Office

N78-13527*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOLAR CELL HIGH EFFICIENCY AND RADIATION DAMAGE
1977 221 p refs Conf. held at Cleveland, 18-19 May 1977 (NASA-CP-2020) Avail: NTIS HC A10/MF A01 CSCL 10A

Silicon solar cell analysis and fundamental measurements, silicon cell technology, gallium arsenide research and technology, and radiation effects on silicon and gallium arsenide cells, are reported. For individual titles, see N78-13528 through N78-13551.

N78-13528*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUMMARY OF THE NASA SPACE PHOTOVOLTAIC RESEARCH AND TECHNOLOGY PROGRAM
Henry W. Brandhorst, Jr. *In its* Solar Cell High Efficiency and Radiation Damage 1977 p 3-6 (For availability see N78-13527 04-44)
Avail: NTIS HC A10/MF A01 CSCL 10A

Low cost solar cells and arrays with high end-of-life efficiency are evaluated through two approaches: one, to obtain increased device efficiency at no increase in cost and two, to reduce the manufacturing costs of space solar cells and arrays. Technology efforts encompass high efficiency epitaxial cells, high efficiency wraparound contact solar cells, economical diffusion sources, automated cell fabrication and development of easily applied, durable cover glasses. The examination of ion-implanted profile tailored junctions and additional development of screen printed contact technology to cell development are also considered.
Author

N78-13529*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GODDARD SPACE FLIGHT CENTER HIGH EFFICIENCY CELL DEVELOPMENT AND EVALUATION PROGRAM
Luther W. Slifer *In its* Solar Cell High Efficiency and Radiation Damage 1977 p 7-23 refs (For availability see N78-13527 04-44)
Avail: NTIS HC A10/MF A01 CSCL 10A

Laboratory tests and flight experiments showed that solar cells can be produced in quantity, that they are suitable for space flight applications, and that the power produced ranged from 20 to 35% more than that of conventional cells. In a benign flight environment, the cells degraded at approximately the same rate as conventional cells. In synchronous orbit, the rate exceeded that of conventional cells, but high efficiency cells still showed significant power advantage after two years. Irradiation test results showed the voltage-temperature coefficients to be comparable to conventional cells. However, current-temperature coefficients were not only higher initially, but also increased significantly with irradiation. Although thin cells with good performance characteristics were made, significant problem areas pertinent to production were disclosed, particularly for cells with thickness of 0.100 mm or less. The overall program

led to the use of advanced high efficiency cells on the International Sun-Earth Explorer solar panels. Author

N78-13530*# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.

A REVIEW OF AIR FORCE SPACE PHOTOVOLTAIC DEVELOPMENT EFFORTS

W. Patrick Rahilly *In* NASA. Lewis Res. Center Solar Cell High Efficiency and Radiation Damage 1977 p 25-31 refs (For availability see N78-13527 04-44)

Avail: NTIS HC A10/MF A01 CSCL 10A

Silicon and gallium arsenide solar cell developments are reviewed. The rationale for these efforts are cited showing the reasons for placing emphasis on survivability as well as high conversion efficiency. Author

N78-13531*# North Carolina State Univ., Raleigh.

IMPURITY GRADIENTS AND HIGH EFFICIENCY SOLAR CELLS

C. R. Fang and J. R. Hauser *In* NASA. Lewis Res. Center Solar Cell High Efficiency and Radiation Damage 1977 p 33-50 refs Sponsored by NASA (For availability see N78-13527 04-44)

Avail: NTIS HC A10/MF A01 CSCL 10A

One potential means of improving the efficiency of solar cells especially after space irradiation is to incorporate built-in fields into the device through the use of impurity doping gradients. A detailed numerical calculation of solar cell performance has been used to study various types of doping gradients. In general, the predicted improvements in performance have been less than previously reported due to various device effects such as, high injection and the dependence of lifetime on doping density. Author

N78-13532*# Florida Univ., Gainesville. Dept. of Electrical Engineering.

MEASUREMENT OF MATERIAL PARAMETERS THAT LIMIT THE OPEN-CIRCUIT VOLTAGE IN P-N-JUNCTION SILICON SOLAR CELLS

F. A. Lindholm, A. Neugroschel, and C. T. Sah (Illinois Univ., Urbana-Champaign) *In* NASA. Lewis Res. Center Solar Cell High Efficiency and Radiation Damage 1977 p 51-58 refs (For availability see N78-13527 04-44)

(Grant NsG-3018; Contract E(40-1)-5134)

Avail: NTIS HC A10/MF A01 CSCL 10A

The greatest gains in solar energy conversion efficiency of p-n-junction silicon solar cells come from increasing the open-circuit voltage V sub OC; it is important to understand and characterize the material parameters that limit the V sub OC. Strong experimental evidence exists to support the assertion that either an anomalously large minority carrier charge storage or an anomalously small minority carrier lifetime in the quasi-neutral emitter region limits the open circuit voltage. A method is presented for measuring charge storage and effective lifetime. Static and transient measurements are analyzed using physical models of the solar cell characteristics. This analysis yields the emitter charge storage and life-time, which then can be related to the various physical mechanisms, such as energy band gap shrinkage, that have been proposed earlier as responsible for limiting V sub OC. Author

N78-13533*# Massachusetts Inst. of Tech., Cambridge.

SURFACE RECOMBINATION VELOCITY AND DIFFUSION LENGTH OF MINORITY CARRIERS IN HEAVILY DOPED SILICON LAYERS

Harry C. Gatos, Masaharu Watanabe, and Geri Actor *In* NASA. Lewis Res. Center Solar Cell High Efficiency and Radiation Damage 1977 p 59-68 refs (For availability see N78-13527 04-44)

Avail: NTIS HC A10/MF A01 CSCL 10A

Quantitative analysis of the electron beam-induced current and the dependence of the effective diffusion length of the minority carriers on the penetration depth of the electron beam were employed for the analysis of the carrier recombination characteristics in heavily doped silicon layers. The analysis is based on the concept of the effective excitation strength of the carriers which takes into consideration all possible recombination sources. Two dimensional mapping of the surface recombination velocity of P-diffused Si layers will be presented together with a three dimensional mapping of minority carrier lifetime in ion implanted Si. Layers heavily doped with As exhibit improved recombination characteristics as compared to those of the layers doped with P. Author

N78-13534*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

IMPURITY CONCENTRATIONS AND SURFACE CHARGE DENSITIES ON THE HEAVILY DOPED FACE OF A SILICON SOLAR CELL

I. Weinberg and Lon Hsu (Wayne State Univ.) *In* NASA. Lewis Res. Center Solar Cell High Efficiency and Radiation Damage 1977 p 69-79 refs (For availability see N78-13527 04-44)

Avail: NTIS HC A10/MF A01 CSCL 10A

Increased solar cell efficiencies are attained by reduction of surface recombination and variation of impurity concentration profiles at the n(+) surface of silicon solar cells. Diagnostic techniques are employed to evaluate the effects of specific materials preparation methodologies on surface and near surface concentrations. It is demonstrated that the MOS C-V method, when combined with a bulk measurement technique, yields more complete concentration data than are obtainable by either method alone. Specifically, new solar cell MOS C-V measurements are combined with bulk concentrations obtained by a successive layer removal technique utilizing measurements of sheet resistivity and Hall coefficient. Author

N78-13535*# Yeshiva Univ., New York.

INVESTIGATION OF THE TOPOGRAPHICAL FEATURES OF SURFACE CARRIER CONCENTRATIONS IN SILICON SOLAR CELL MATERIAL USING ELECTROLYTE ELECTRO-REFLECTANCE

Fred H. Pollay, Cajetan E. Okeke, and Paul M. Raccah *In* NASA. Lewis Res. Center Solar Cell High Efficiency and Radiation Damage 1977 p 81-90 refs (For availability see N78-13527 04-44)

(Grant NsG-3123)

Avail: NTIS HC A10/MF A01 CSCL 10A

Topographical variations in carrier concentration delta N/N across the surface of n(+) on p diffused silicon solar cell material are studied by utilizing electrolyte electroreflectance with a spatial resolution of 100 microns within approximately 500 A of the surface. The topographical variations of delta N/N approximately 10 - 20% are found to be comparable to Czochralski grown material. The electroreflectance method can also be utilized to investigate other semiconductors such as GaAs. Author

N78-13536*# Spectrolab, Inc., Sylmar, Calif.

ADVANCED HIGH EFFICIENCY WRAPAROUND CONTACT SOLAR CELL

J. A. Scott-Monck, F. M. Uno, and J. W. Thornhill *In* NASA. Lewis Res. Center Solar Cell High Efficiency and Radiation Damage 1977 p 91-94 refs Presented at AIAA Conf. on the Future of Aerospace Power Systems, St. Louis, 1-3 Mar. 1977 Sponsored by NASA (For availability see N78-13527 04-44)

(AIAA-Paper-77-521) Avail: NTIS HC A10/MF A01 CSCL 10A

A significant advancement in the development of thin high efficiency wraparound contact silicon solar cells has been made by coupling space and terrestrial processing procedures. Although this new method for fabricating cells has not been completely reduced to practice, some of the initial cells have delivered over 20 mW/sq cm when tested at 25 C under AMO intensity. This approach not only yields high efficiency devices, but shows promise of allowing complete freedom of choice in both the location and size of the wraparound contact pad area. Author

N78-13537*# Communications Satellite Corp., Washington, D.C.

THE SAWTOOTH COVER SLIDE

A. Meulenberg, Jr. *In* NASA. Lewis Res. Center Solar Cell High Efficiency and Radiation Damage 1977 p 95-98 refs (For availability see N78-13527 04-44)

Avail: NTIS HC A10/MF A01 CSCL 10A

A novel cover slide is reported which increases solar cell output by reducing the reflection of light from the cover slide surface and by redirecting incident light so that none falls on the collection grids of the cell. The new cover slide is fabricated

with a sawtooth surface having a periodicity equal to that of the solar cell grids. This configuration refracts the light so that it is directed onto the semiconductor surface between the grid lines. Conventional grid patterns obstruct 7-10 percent of the light incident on the cell; at least half of this loss has been recovered by using the sawtooth cover slide. In addition, surface reflection from the conventional coated cover slide is suppressed by presenting a second surface to any light reflected at the first plane of contact. This double reflection results in a greater reduction of the reflection loss from the cover slide than does an antireflection coating on a flat surface. Author

N78-13538*# Simulation Physics, Inc., Foxborough, Mass.
APPLICATIONS OF ION IMPLANTATION FOR HIGH EFFICIENCY SILICON SOLAR CELLS
John A. Minnucci and Allen R. Kirkpatrick *In* NASA. Lewis Res. Center Solar Cell High Efficiency and Radiation Damage 1977 p 99-108 refs (For availability see N78-13527 04-44) (Contract F33615-75-C-2006)
Avail: NTIS HC A10/MF A01 CSCL 10A

Ion implantation is utilized for the dopant introduction processes necessary to fabricate a silicon solar cell. Implantation provides a versatile powerful tool for development of high efficiency cells. Advantages and problems of implantation and the present status of developmental use of the technique for solar cells are discussed. Author

N78-13539*# Oak Ridge National Lab., Tenn.
TRANSMUTATION DOPING OF SILICON SOLAR CELLS
R. F. Wood, R. D. Westbrook, R. T. Young, and J. W. Cleland *In* NASA. Lewis Res. Center Solar Cell High Efficiency and Radiation Damage 1977 p 109-116 refs (For availability see N78-13527 04-44)
Avail: NTIS HC A10/MF A01 CSCL 10A

Normal isotopic silicon contains 3.05% of Si-30 which transmutes to P-31 after thermal neutron absorption, with a half-life of 2.6 hours. This reaction is used to introduce extremely uniform concentrations of phosphorus into silicon, thus eliminating the areal and spatial inhomogeneities characteristic of chemical doping. Annealing of the lattice damage in the irradiated silicon does not alter the uniformity of dopant distribution. Transmutation doping also makes it possible to introduce phosphorus into polycrystalline silicon without segregation of the dopant at the grain boundaries. The use of neutron transmutation doped (NTD) silicon in solar cell research and development is discussed. Author

N78-13540*# Solarex Corp., Rockville, Md.
DEVELOPMENTS IN VERTICAL-JUNCTION SILICON SOLAR CELLS
J. Lindmayer, C. Wrigley, and J. Wohlgemuth *In* NASA. Lewis Res. Center Solar Cell High Efficiency and Radiation Damage 1977 p 117-125 refs (For availability see N78-13527 04-44) (Contract F33615-76-C-2058)
Avail: NTIS HC A10/MF A01 CSCL 10A

Non-reflective vertical junction silicon cells provide high conversion efficiency radiation-resistant solar cells. New techniques of oxidation growth and the use of photolithography enable the use of an orientation dependent etch producing grooves 5 to 10 microns wide over 100 microns deep. These silicon wafers are then processed into solar cells with all of the processes performed at temperatures compatible with producing high efficiency solar cells. Most of the photogenerated carriers are created in the walls where they are within a few microns of the collecting junction. Consequently, degradation of carrier diffusion length due to radiation has a considerably reduced effect on collection efficiency. These 2 cm x 2 cm vertical junction silicon solar cells have exceeded 13% AMO efficiency and have shown superior radiation resistance. Author

N78-13541*# Hughes Aircraft Co., Culver City, Calif. Space and Communications Group.
PROJECT STOP (SPECTRAL THERMAL OPTIMIZATION PROGRAM)
L. J. Goldhammer, R. W. Opjorden, G. S. Goodelle, and J. S. Powe *In* NASA. Lewis Res. Center Solar Cell High Efficiency and Radiation Damage 1977 p 127-132 (For availability see N78-13527 04-44)
Avail: NTIS HC A10/MF A01 CSCL 10A

The spectral thermal optimization of solar cell configurations for various solar panel applications is considered. The method of optimization depends upon varying the solar cell configuration's optical characteristics to minimize panel temperatures, maximize power output and decrease the power delta from beginning of life to end of life. Four areas of primary investigation are: (1) testing and evaluation of ultraviolet resistant coverslide adhesives, primarily FEP as an adhesive; (2) examination of solar cell absolute spectral response and corresponding cell manufacturing processes that affect it; (3) experimental work with solar cell manufacturing processes that vary cell reflectance (solar absorptance); and (4) experimental and theoretical studies with various coverslide filter designs, mainly a red rejection filter. The Hughes' solar array prediction program has been modified to aid in evaluating the effect of each of the above four areas on the output of a solar panel in orbit. Author

N78-13542*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HIGH EFFICIENCY GaAs SOLAR CELLS
Gilbert H. Walker, Edmund J. Conway, and Charles E. Byvik *In its* Solar Cell High Efficiency and Radiation Damage 1977 p 133-138 (For availability see N78-13527 04-44)
Avail: NTIS HC A10/MF A01 CSCL 10A

The present status of the GaAlAs/GaAs heteroface solar cell program is reported. Studies have been concentrated on GaAlAs/GaAs heteroface solar cells; however, some research has been conducted on thin junction, diffused GaAs solar cells. Emphasis has been on obtaining high efficiency (18% to 20%) GaAs solar cells. Two problems that have limited the efficiency of GaAs solar cells are the high recombination velocity of carriers near the surface and the low minority carrier diffusion length in n-GaAs. Author

N78-13543*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THEORETICAL STUDIES OF A NEW DOUBLE GRADED BAND-GAP Al SUB x Ga SUB 1-x As-Al SUB Y Ga SUB 1-y As
James A. Hutchby *In its* Solar Cell High Efficiency and Radiation Damage 1977 p 139-147 refs (For availability see N78-13527 04-44)
Avail: NTIS HC A10/MF A01 CSCL 10A

A new double graded band-gap (DGBG) Al sub x Ga sub l-x As-Al sub z Ga sub l-z As solar cell has potential for providing high efficiency performance throughout the entire life of a solar cell in a space environment. A preliminary theoretical analysis indicates that short circuit current available from an optimized DGBG cell is slightly larger than that of a previously reported single graded band-gap cell. However, the DGBG cell potentially offers a substantial improvement in radiation resistance of the base region. Author

N78-13544*# Hughes Research Labs., Malibu, Calif.
GaAs SOLAR CELL DEVELOPMENT
R. C. Knechtli, S. Kamath, and R. Loo *In* NASA. Lewis Res. Center Solar Cell High Efficiency and Radiation Damage 1977 p 149-157 (For availability see N78-13527 04-44)
Avail: NTIS HC A10/MF A01 CSCL 10A

The motivation for developing GaAs solar cells is based on their superior efficiency when compared to silicon cells, their lower degradation with increasing temperature, and the expectation for better resistance to space radiation damage. The AMO efficiency of GaAs solar cells was calculated. A key consideration in the HRL technology is the production of GaAs cells of large area (greater than 4 sg cm) at a reasonable cost without sacrificing efficiency. An essential requirement for the successful fabrication of such cells is the ability to grow epitaxially a uniform layer of high quality GaAs (buffer layer) on state-of-the-art GaAs substrates, and to grow on this buffer layer the required than layer of (AlGa)As. A modified infinite melt liquid phase epitaxy (LPE) growth technique is detailed. Author

N78-13545*# State Univ. of New York, Albany. Inst. for the Study of Defects in Solids.
THE STATUS OF DEFECT STUDIES PERTINENT TO RADIATION DAMAGE IN SILICON SOLAR CELLS

J. W. Corbett, L. J. Cheng, J. C. Corelli, and Y. H. Lee *In* NASA. Lewis Res. Center Solar Cell High Efficiency and Radiation Damage 1977 p 159-164 refs (For availability see N78-13527 04-44)
(Grant NsG-3095; Contract N00014-75-C-0919)
Avail: NTIS HC A10/MF A01 CSCL 10A

The status of radiation defects in silicon is briefly reviewed and discussed in relation to the problem of radiation tolerance of silicon solar cells in space. Author

N78-13548*# State Univ. of New York, Albany. Inst. for the Study of Defects in Solids.
EFFECTS OF DEFECT RECOMBINATION CENTERS ON RADIATION DAMAGE IN SOLAR CELLS
L. J. Cheng, P. W. Sours, J. P. Karins, J. C. Corelli, and J. W. Corbett *In* NASA. Lewis Res. Center Solar Cell High Efficiency and Radiation Damage 1977 p 165-178 refs (For availability see N78-13527 04-44)
(Grant NsG-3095; Contract N00014-75-C-0919)
Avail: NTIS HC A10/MF A01 CSCL 10A

Defect production in silicon is modeled on a computer by solving a large system of rate equations. The model includes the main, known defects that are stable at operating temperatures of solar cells in outer space; most of these defects are secondary and tertiary defects. The preliminary result shows that the presence of defect recombination centers for primary defects (i.e., vacancy and interstitial) can effectively reduce the production rates of those stable defects and, consequentially, improve the lifetime of solar cells operating in radiation environment. The characteristics of the defect recombination center required for better solar cell performance along with prospective candidates are discussed. Author

N78-13547*# State Univ. of New York, Albany. Inst. for the Study of Defects in Solids.
EPR AND TRANSIENT CAPACITANCE STUDIES ON ELECTRON-IRRADIATED SILICON SOLAR CELLS
Y. H. Lee, L. J. Cheng, P. M. Mooney, and J. W. Corbett *In* NASA. Lewis Res. Center Solar Cell High Efficiency and Radiation Damage 1977 p 179-186 refs (For availability see N78-13527 04-44)
(Grant NsG-3095; Contract N00014-75-C-0919)
Avail: NTIS HC A10/MF A01 CSCL 10A

One and two ohm-cm solar cells irradiated with 1 MeV electrons at 30 C were studied using both EPR and transient capacitance techniques. In 2 ohm-cm cells, Si-G6 and Si-G15 EPR spectra and majority carrier trapping levels at (E sub V + 0.23) eV and (E sub V + 0.38) eV were observed, each of which corresponded to the divacancy and the [carbon-oxygen-vacancy] complex, respectively. In addition, a boron-associated defect with a minority carrier trapping level at (E sub C -0.27) eV was observed. In 1 ohm-cm cells, the G15 spectrum and majority carrier trap at (E sub V + 0.38) eV were absent and an isotropic EPR line appeared at g = 1.9988 (+ or - 0.0003); additionally, a majority carrier trapping center at (E sub V + 0.32) eV, was found which could be associated with impurity lithium. The formation mechanisms of these defects are discussed according to isochronal annealing data in electron-irradiated p-type silicon. Author

N78-13548*# Boeing Aerospace Co., Seattle, Wash.
RADIATION TESTS OF SEP SOLAR CELLS
Henry Oman *In* NASA. Lewis Res. Center Solar Cell High Efficiency and Radiation Damage 1977 p 187-205 (For availability see N78-13527 04-44)
(Contract NAS8-31670)
Avail: NTIS HC A10/MF A01 CSCL 10A

Solar cells specially designed for Solar Electric Propulsion (SEP) were tested with radiation fluences up to 10 to the 12th power protons having energies of 1.5, 1.0, and 0.5 MeV, and with fluences up to 10 to the 16th power electrons having 1.0 MeV energy. Spectrolab cells having a back-surface field were also irradiated with the same particles and fluences. Cell performances are described by curves in which normalized and absolute values of maximum power, maximum-power voltage, short-circuit current, and open-circuit voltage are plotted as a function of fluence. Author

N78-13549*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ELECTRON IRRADIATION OF MODERN SOLAR CELLS
Bruce E. Anspaugh and Tetsuo F. Miyahira (Xerox Electro-Optical Systems) *In its* Solar Cell High Efficiency and Radiation Damage 1977 p 207-220 (For availability see N78-13527 04-44)
(Contract NAS7-100)
Avail: NTIS HC A10/MF A01 CSCL 10A

A number of modern solar cell types representing 1976 technology (as well as some older types) were irradiated with 1 MeV electrons (and a limited number with 2 MeV electrons and 10 MeV protons). After irradiation, the cells were annealed, with I-V curves measured under AMO at 30 C. The purpose was to provide data to be incorporated in the revision of the solar cell radiation handbook. Cell resistivities ranged from 2 to 20 ohm-cm, and cell thickness from 0.05 to 0.46 mm. Cell types examined were conventional, shallow junction, back surface field (BSF), textured, and textured with BSF. Author

N78-13550*# Communications Satellite Corp., Washington, D.C.
IONIZATION INDUCED DAMAGE IN CRYSTALLINE SILICON
A. Meulenberg, Jr. *In* NASA. Lewis Res. Center Solar Cell High Efficiency and Radiation Damage 1977 p 221-223 refs (For availability see N78-13527 04-44)
Avail: NTIS HC A10/MF A01 CSCL 10A

Close examination of the interaction of the energetic knock-on atoms with the local lattice environment reveals a damage mechanism which does satisfy the experimental data on proton irradiation of silicon. A proton-atom interaction with high energy transfer is considered where the proton path is delineated by a trail of ionization, and the silicon ion path is characterized by much heavier ionization terminating in a dense displacement cluster. At collision, many of the silicon electrons are stripped off, and the resulting energetic ion subsequently loses energy rapidly by Coulomb interaction with bound electrons. The rate of energy loss depends on the charge state and velocity of the knock-on ion. For ion energies in excess of 1 MeV, the intensity of ionization is sufficient to permit lattice atoms, stripped of their binding electrons, to reorient randomly before having an opportunity to recombine with electrons and re-establish the lattice. The path of a knock-on ion thus becomes a thin cylinder of amorphous material within the crystal. Amorphous silicon has a Fermi level closer to mid-band than does single crystal silicon, and a strong field therefore, results around this damaged region. The field produces a large depletion region, representing a very large capture cross section for minority carriers. Author

N78-13551*# Communications Satellite Corp., Washington, D.C.
ULTRAVIOLET DAMAGE IN SOLAR CELL ASSEMBLIES WITH VARIOUS UV FILTERS
A. Meulenberg, Jr. *In* NASA. Lewis Res. Center Solar Cell High Efficiency and Radiation Damage 1977 p 227-229 ref (For availability see N78-13527 04-44)
Avail: NTIS HC A10/MF A01 CSCL 10A

Ultraviolet damage to the new violet and non-reflective type solar cell assemblies, was studied, and potential advantages of using coverslides with no filters or filters with cut-off wavelengths below 0.35 micron were determined. The experiments consisted of three types of tests on fused silica coverslides with 0.35- and 0.30-micron cut-off filters and no cut-off filters, as well as on ceria-doped microsheet coverslides. Ultraviolet irradiation for over 1500 hours at one sun conditions (AMO) was carried out under vacuum of about 1 million torr. Nearly identical results for non-reflective type cells with 0.35-micro cut-off filters or ceria-doped coverslides were obtained. The 0.30-um filtered cell shows greater than average degradation. The unfiltered cell shows an abrupt drop in the first 20 UVSH and very little subsequent degradation. Author

N78-13552*# Alabama A & M Univ., Huntsville. School of Technology.
PARAMETRIC STUDY OF ROCK PILE THERMAL STORAGE FOR SOLAR HEATING AND COOLING PHASE 1 Final Report
Hrishikesh Saha Oct. 1977 49 p refs
(Grant NsG-8041)
(NASA-CR-155336) Avail: NTIS HC A03/MF A01 CSCL 10A

The test data and an analysis were presented, of heat transfer characteristics of a solar thermal energy storage bed utilizing water filled cans as the energy storage medium. An attempt was made to optimize can size, can arrangement, and bed flow rates by experimental and analytical means. Liquid filled cans, as storage media, utilize benefits of both solids like rocks, and liquids like water. It was found that this combination of solid and liquid media shows unique heat transfer and heat content characteristics and is well suited for use with solar air systems for space and hot water heating. An extensive parametric study was made of heat transfer characteristics of rocks, of other solids, and of solid containers filled with liquids. Author

N78-13553*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CANDIDATE LOCATIONS FOR SPS RECTIFYING ANTENNAS
Anne W. Eberhardt Nov. 1977 92 p refs
(NASA-TM-78146) Avail: NTIS HC A05/MF A01 CSCL 10A

The feasibility of placing 120 Satellite Power System (SPS) rectifying antenna (rectenna) sites across the U.S. was studied. An initial attempt is made to put two land sites in each state using several land site selection criteria. When only 69 land sites are located, it is decided to put the remaining sites in the sea and sea site selection criteria are identified. An estimated projection of electrical demand distribution for the year 2000 is then used to determine the distribution of these sites along the Pacific, Atlantic, and Gulf Coasts. A methodology for distributing rectenna sites across the country and for fine-tuning exact locations is developed, and recommendations on rectenna design and operations are made. Author

N78-13554*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOLAR ENERGY BIBLIOGRAPHY
Stephen Gargus, comp. Jul. 1977 32 p
(NASA-TM-X-73398) Avail: NTIS HC A03/MF A01 CSCL 10A

Listings are provided of technical briefs, reports, and papers pertaining to research being performed in the field of solar energy. Author

N78-13555# Lockheed Missiles and Space Co., Palo Alto, Calif.
EXPERIENCE IN UTILIZING AN ADSORPTION SOLAR COOLING PLANT (ASCP) WITH OPEN REGENERATOR OF THE SOLUTION
A. A. Kakabaev, O. Klyshchaeva, A. Khandurdyev, and N. Kurbanov 1977 6 p refs Transl. into ENGLISH from Geliotekhnika (USSR), no. 4, 1977 p 73-76
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Information is provided to clarify the advantages and disadvantages of a ASCP. A specific experience in the use of such a system is described, presenting details of the solar house's architecture, particularly emphasizing the regenerator system. Disadvantages cited include corrosion of the absorber and evaporator tube surfaces, as well as contamination of the solution and its subsequent filtration. Advantages are indicated by specific operating temperatures, the system's comparative simplicity and its high coefficient of solar radiation utilization. Author

N78-13556*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AN IMPROVED SOLAR CONCENTRATOR Patent Application
John G. Simpson, inventor (to NASA) Filed 30 Nov. 1977 15 p
(NASA-Case-MFS-23727-1; US-Patent-Appl-SN-856465) Avail: NTIS HC A02/MF A01 CSCL 10A

A solar energy conversion device is described. The device is embodied in an improved solar concentrator characterized by elongated supporting members arranged in substantial horizontal parallelism with the axes thereof intersecting a common curve and a tensioned sheet of flexible reflective material disposed in engaging relation with the supporting members for imparting thereto a catenary configuration. The supporting members comprise tensioned wires about which a flexible sheet is drawn. The supporting members comprise rods inserted into tubular receptacles transversely related to a flexible sheet whereby the sheet is tensioned by the weight of the rods. The instant invention provides a simple economic and efficient solar energy concentrator particularly suited for use with systems provided for converting solar energy to heat in dwellings and similar structures. NASA

N78-13557# Office of Telecommunications, Washington, D. C.
THE CONTRIBUTION OF TELECOMMUNICATIONS TO THE CONSERVATION OF ENERGY RESOURCES
Michael Tyler, Martin Elton, and Angela Cook Jul. 1977 84 p refs
(PB-270977/2; OT-SP-77-17) Avail: NTIS HC A05/MF A01 CSCL 10A

Telecommunications applications to promote efficient use of energy are considered for: (1) interactions between telecommunications and demand for transport; (2) improving efficiency of transport; and (3) issues revolving around the changes in office work and location made possible by advances in telecommunications and computer systems. GRA

N78-13558# Faucett (Jack) Associates, Inc., Chevy Chase, Md.
ENERGY CONSUMPTION IN COMMERCIAL INDUSTRIES BY CENSUS DIVISION - 1974
Hiliary A. Kaufman, William Anderson, James McElroy, Kay Kennery, and Loe J. Mueller Mar. 1977 365 p
(Contract FEA-CO-03-50346-00)
(PB-268851/3; FEA/B-77/167) Avail: NTIS HC A16/MF A01 CSCL 10A

Secondary data collections are reported that were compiled by many different public and private organizations for the various segments of the commercial sector. Following a common methodology, the data are estimated for the various segments of each of the commercial sectors, and then Census Division and national totals are developed. GRA

N78-13559# ICF, Inc., Washington, D. C.
PROJECT INDEPENDENCE EVALUATION SYSTEM (PIES) DOCUMENTATION. VOLUME 4: FEA MODEL OF OIL AND GAS SUPPLY: DATA VALIDATION AND UPDATE
Sep. 1976 53 p
(Contract FEA-CO-05-50301-00)
(PB-270385/8; FEA/N-76/414-Vol-4) Avail: NTIS HC A04/MF A01 CSCL 08I

A detailed and comprehensive discussion of the oil and gas supply model is presented which is used to construct the oil and gas supply curves. It provides an overview description of the model and the modeling methodology as well as details on the data input requirements. GRA

N78-13560# Northwestern Technological Inst., Evanston, Ill.
HEAT EXTRACTION FROM HOT, DRY ROCK MASSES Progress Report, 1 Aug. 1976 - 31 Jan. 1977
J. Weertman, J. D. Achenbach, Z. P. Bazant, J. Dundurs, and L. M. Keer Mar. 1977 82 p refs
(Grant NSF AER-75-00187)
(PB-271411/1; NSF/RA-770172) Avail: NTIS HC A05/MF A01 CSCL 08I

In analytical studies of three dimensional crack growth and shape, crack orientation was studied and the condition of a circular crack was relaxed. A method is under study to determine the crack shape when the pressure of fluid in the crack is prescribed. The growth and stability of parallel, thermally induced edge cracks were investigated as a function of a thermal wave progressing from a free surface, both analytically and by finite element numerical techniques. The geometrical theory of diffraction in three dimensional elastodynamics was applied to the problem of diffraction by a large crack of a signal emanating from a point source. GRA

N78-13561# Air Force Academy, Colo. Frank J. Seiler Research Lab.
THE DISCHARGE BEHAVIOR OF A LiAl/NaAlCl4/CuCl2 PELLETIZED THERMAL CELL Technical Report, Jan. 1976 - Feb. 1977
John K. Erbacher, Charles L. Hussey, and Lowell A. King Feb. 1977 63 p refs
(AF Proj. 2303)
(AD-A045620; FJSRL-TR-77-0001) Avail: NTIS

HC A04/MF A01 CSCL 10/3

Pelletized thermal battery single cell experiments on the lithium-aluminum alloy/sodium tetrachloroaluminate/copper (II) chloride electrochemical system are described. The effects of copper (II) chloride particle size, brand of graphite in the cathode, variation of the Li content of the alloy anodes, current density, and discharge temperature under constant current discharge conditions are discussed. A mechanism for the reaction of LiAl alloys in the NaAlCl4 electrolyte is proposed. GRA

N78-13562# TRW Systems Group, Redondo Beach, Calif. Power Conversion Electronics Dept.

TWO POINT FOUR KW DC/DC CONVERTER REGULATOR Final Technical Report, Apr. 1975 - Dec. 1976

John J. Biess Aug. 1977 92 p refs

(Contract DAAB07-75-C-1324; DA Proj. 1L7-62705-AH-94) (AD-A045654; TRW-27977-6002-RU-00; ECOM-75-1324-F) Avail: NTIS HC A05/MF A01 CSCL 09/5

The 2.4KW DC-DC Converter/Regulator Power Module furnishes o-75 ADC over an output voltage range of 24 to 32 VDC from a nominal 20-40 VDC unregulated power source and can be used for battery charging from 5 to 75A. Remote output voltage sensing at the load circuit is provided to eliminate the IR drops of the power distribution cabling between the power module and the load. A series inductor/parallel inverter power stage is used to provide the output power control and regulation input/output ground isolation and protection of the switching power transistors. The power supply is constructed in accordance with the Shelter-installed, Mobile C-E Equipment destined for shelter or van use without the fans used for cooling. The internal electronics are modularized according to circuit function with provision for easy removal of repair. Reliability, efficiency, weight and size achieved are approximately 8200 hours (MTBF), 847, 73.3 lbs. 196 cu. ft., respectively. Author (GRA)

N78-13563# National Bureau of Standards, Washington, D. C. Solar Energy Program.

INTERMEDIATE STANDARDS FOR SOLAR DOMESTIC HOT WATER SYSTEMS/HUD INITIATIVE

Jul. 1977 153 p refs

(PB-271758/5; NBSIR-77-1272) Avail: NTIS HC A08/MF A01 CSCL 13A

Standards are presented for the use of solar domestic hot water systems in residential applications. The standards were developed for application in numerous housing programs of the Department of Housing and Urban Development and are to be used in conjunction with the HUD Minimum Property Standards for One and Two Family Dwellings, and Minimum Property Standards for Multifamily Housing. GRA

N78-13564# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.

RESEARCH TOWARD IMPROVED FLYWHEEL SUSPENSION AND ENERGY CONVERSION SYSTEMS Interim Technical Report, 1 Jul. 1975 - 31 Dec. 1975

David Eisenhaure, George Oberbeck, Stephen ODea, and William Stanton Mar. 1976 94 p refs

(Grant NSF AER-75-18813)

(PB-271413/7; R-960; NSF/RA-761119) Avail: NTIS HC A05/MF A01 CSCL 10C

Suspension and energy conversion systems for use in conjunction with flywheel energy storage were studied. A detailed set of system requirements which would allow two-way power flow between a high-speed flywheel shaft and a 60-Hz line was outlined. A special-purpose integrated rotating machine and power-switching stage were designed. A special-purpose low-loss magnetic suspension system was designed which will allow efficient 24-hour cycle energy storage. A computer model of the flywheel and suspension system was developed to aid in the determination of critical suspension and control parameters and evaluation of system performance. GRA

N78-13565# Westinghouse Research Labs., Pittsburgh, Pa.

INVESTIGATION OF METHODS TO IMPROVE HEAT PUMP PERFORMANCE AND RELIABILITY IN A NORTHERN CLIMATE. VOLUME 3: APPENDICES B, C, D Final Report

H. S. Kirschbaum and S. E. Veyo Jan. 1977 480 p

(EPRI Proj. 544-1)

(EPRI-EM-319-Vol-3-App-B; EPRI-EM-319-Vol-3-App-C; EPRI-EM-319-Vol-3-App-D) Avail: NTIS HC A21/MF A01

The potential for improving the performance, reliability, cost, and energy demand of heat pumps for use in northern climates was evaluated. Results of the various analyses are presented. ERA

N78-13566# Westinghouse Research Labs., Pittsburgh, Pa.

INVESTIGATION OF METHODS TO IMPROVE HEAT PUMP PERFORMANCE AND RELIABILITY IN A NORTHERN CLIMATE. VOLUME 2: APPENDIX A APPENDIX A Final Report

H. S. Kirschbaum Jan. 1977 574 p refs

(EPRI Proj. 544-1)

(EPRI-EM-319-Vol-2-App-A) Avail: NTIS HC A24/MF A01

The following appendices to a final report on evaluating the potential for improving the performance, reliability, cost, and energy demand of heat pumps for use in northern climates are included in this volume: climate characterization; building characterization; manufacturer's data for HVAC equipment; residential heat pump sizing practices for northern climates; on/off cycle analysis; seasonal performance computer program listing and results; HVAC system base case performance for single and multiple family residences; reliability establishment; and the REL-PUMP computer program user's guide. ERA

N78-13567# Westinghouse Electric Corp., Pittsburgh, Pa.

INVESTIGATION OF METHODS TO IMPROVE HEAT PUMP PERFORMANCE AND RELIABILITY IN A NORTHERN CLIMATE. FINAL REPORT, VOLUME 1

H. S. Kirschbaum and S. E. Veyo Jan. 1977 436 p

(EPRI-EM-319-Vol-1) Avail: NTIS HC A19/MF A01

The potential for improving heat pump performance and reliability for application in northern climates was evaluated. Component and subsystem improvements with the potential for implementation by 1980 were identified. Improved systems were then configured and analyzed for their benefits to, and impacts on, consumers, electric utilities, and the manufacturing industry. Air-to-air heat pumps were emphasized and the impacts of storage and/or solar augmentation were investigated. Three utility service territories were selected to illustrate annual life cycle cost optimization for the case of a flat electricity rate structure. Five improved heat pump systems were identified and analyzed for performance, reliability, cost, utility impacts, and development requirements. ERA

N78-13568# Energy Research and Development Administration, Washington, D. C. Div. of Conservation Research and Technology.

ENERGY CONSERVATION R AND D OBJECTIVES WORKSHOP. VOLUME 1: WORKING PAPERS

1977 136 p Presented at Energy Conserv. Res. and Develop. Objectives Workshop, San Diego, Calif., 6 Mar. 1977

(CONF-770305-P1) Avail: NTIS HC A07/MF A01

The Div. of Conservation Research and Technology (CONRT) prepared a series of working papers to familiarize participants with some of the issues that were slated for discussion at the workshops. Included are: an overview of the energy problem and the roles of public and private sector R and D activities; a summary of the CONRT Planning Process by which CONRT selects and evaluates projects and the role workshops play in that process; the national, ERDA, and CONRT objectives that guide federal energy R and D activities; a discussion of some of the socio-economic factors that affect energy R and D activities; an example of the type of discussion that might occur at a workshop; technical papers on combustion and fuels technology, heat cycles, and supporting technologies, and a discussion of strategies for making a shift from oil and natural gas to alternate fuels. ERA

N78-13569# Energy Research and Development Administration, Washington, D. C. Div. of Conservation Research and Technology.

ENERGY CONSERVATION R AND D OBJECTIVES WORKSHOP. VOLUME 2: SUMMARY

D. J. Monetta, ed. 1977 27 p Presented at Energy Conserv. Res. and Develop. Objectives Workshop, San Diego, Calif., 6 Mar. 1977

(CONF-770305-Pt-2) Avail: NTIS HC A03/MF A01

The purpose of the meeting was to test a new method of gathering information for the Div. of Conservation Research and Technology (CONRT) planning process and, to the extent that the first objective was achieved, to actually gather information for CONRT's current planning process. For this experiment, CONRT and the Coast Community College District, the local host of the workshop, assembled representatives from ERDA, industry, the academic community, and the general public to discuss and critique CONRT's activities and planning process. Participants met in general sessions and in three smaller panels devoted to specific areas of interest to CONRT. The first workshop proceedings are described, the results are summarized, and major conclusions and recommendations are presented. ERA

N78-13570# Union Carbide Corp., Oak Ridge, Tenn. Nuclear Div.
COMPOSITE FLYWHEEL DEVELOPMENT COMPLETION Completion Report, 1 May - 30 Sep. 1976
R. L. Huddleston, J. J. Kelly, and C. E. Knight May 1977 44 p refs
(Contract W-7405-eng-26)
(Y-2080) Avail: NTIS HC A03/MF 01

The program to design, fabricate, and performance test a prototype, vehicular-sized, composite flywheel is described. The development effort was successful, leading to successful testing of a flywheel design which demonstrated an energy density performance of 10.1 Wh/lb during spin testing. The initial application selected for development of the composite flywheel was the heat engine/flywheel hybrid propulsion system for a vehicle. Applications, such as utility load leveling, represent potential areas for significant energy savings but require more extensive development programs and funding resources. Successful development of a high-performance, composite, vehicular flywheel represents one step along the development path leading toward larger, higher-energy storage flywheel applications. ERA

N78-13571# Battelle Pacific Northwest Labs., Richland, Wash.
INVESTIGATION OF INTERNATIONAL ENERGY ECONOMICS
D. E. Deonigi, M. Clement, T. J. Foley, and S. A. Rao Mar. 1977 94 p
(Contract EY-76-C-06-1830)
(BNWL-2134) Avail: NTIS HC A05/MF A01

A program was designed to coordinate the capabilities of five research groups to evaluate international economics. This program is designed to be general, flexible, and capable of evaluating a diverse collection of potential energy (nuclear and nonnuclear related problems). For example, the newly developed methodology could evaluate the international and domestic economic impact of nuclear-related energy sources, but also existing nonnuclear and potential energy sources such as solar, geothermal, wind, etc. Major items to be included would be the cost of exploration, cost of production, prices, profit, market penetration, investment requirements and investment goods, economic growth, change in balance of payments, etc. In addition, the changes in cost of producing all goods and services would be identified for each new energy source. ERA

N78-13572# Institute of Gas Technology, Chicago, Ill.
DEVELOPMENT OF AN INDUSTRY-GOVERNMENT COOPERATIVE ENERGY CONSERVATION PROGRAM FOR SMALL MANUFACTURERS, PHASE 1. PROJECT 8978 Final Report
M. E. Fejer and P. A. Ketels Nov. 1976 28 p
(Contract EY-76-C-02-2852)
(COO-2852-2) Avail: NTIS HC A03/MF A01

Energy conservation programs are evaluated. The approach being taken in this program is one in which the trade association representing the various small manufacturers agree to cooperate in providing the necessary contacts and data for evaluating their respective industries. The program is divided into three phases,: three associations volunteered to participate. ERA

N78-13573# Brookhaven National Lab., Upton, N. Y.
RESIDENTIAL ENERGY DEMAND ANALYSIS: DATA AND METHODOLOGY
W. Marcuse, Steven C. Carhart, and Shirish Mulherkar Oct. 1976 35 p refs Presented at the Joint Natl. Meeting of the Operations Res. Soc. of Am. and the Inst. of Management Sci., Miami, Fla., 3-6 Nov. 1976
(Contract EY-76-C-02-0016)
(BNL-21920; Conf-761167-1) Avail: NTIS HC A03/MF A01

An energy system and optimization model has been used for technology assessment and policy analysis by the Energy Research and Development Administration. Most supply technologies and end-use conversion devices are characterized in the model. Extension of the model to incorporate a more detailed characterization of end-use devices, utilizing systems (e.g., housing type and class of insulation), and use factors is needed to assess conservation research and development options. This paper describes the first stage of these extensions to energy end-use demands in the residential sector. Upon completion of this work, extension to commercial, industrial and transportation sectors will be pursued. ERA

N78-13574# Battelle Pacific Northwest Labs., Richland, Wash.
OUR ENERGY FUTURE: WHERE IS REALITY
R. D. Widrig Nov. 1976 12 p Presented at the Natl. Sci. Teachers Assoc. Conf., Seattle, 5 Nov. 1976
(Contract E(45-1)-1830)
(BNWL-SA-6029; Conf-761171-1) Avail: NTIS HC A02/MF A01

Electric power generation in the northwest on United States is discussed. The main considerations are: decisions made today will stand for ten years or more and are irreversible; only coal and nuclear power are options available in the Northwest; coal and nuclear power must be utilized to alleviate power outages leading to rationing and allocation measures; and conservation of electricity will benefit all. ERA

N78-13575# Stanford Research Inst., Menlo Park, Calif.
FUEL AND ENERGY PRICE FORECASTS. VOLUME 2: DATA BASE Final Report
Feb. 1977 309 p refs
(EPRI-EA-433-Vol-2) Avail: NTIS HC A14/MF A01

The data base for the energy model as of August 1976 encompasses the following: (1) a network used to describe the production processing, transportation, and end-use consumption of energy materials; (2) the economics of energy conversion processes that require at least one fuel as a primary feedstock and produce at least one primary energy product and end-use conversion, (3) a description of how the relationship between the marginal cost of primary sources (excluding economic rent) and cumulative production of these resources-coal, domestic crude oil, natural gas, imported oil and gas, nuclear fuel, shale oil, geothermal, biomass, and hydropower-are developed; (4) initial energy balances: specification of flow at each mode of the network in energy balance required by the energy model; (5) a model to project usable energy (end-use) demand as a function of usable energy prices (marginal costs) and other variables such as GNP or economic activity by sector, population growth, and mandatory or technologically induced changes in energy use; and (6) the dynamics of the energy market. ERA

N78-13576# Oak Ridge National Lab., Tenn.
CONSENSUS FORECAST OF US ENERGY SUPPLY AND DEMAND TO THE YEAR 2000
J. A. Lane Feb. 1970 31 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5369) Avail: NTIS HC A03/MF A01

Methods used in forecasting energy supply and demand are described, and recent forecasts are reviewed briefly. Forecasts to the year 2000 are displayed in tables and graphs and are used to prepare consensus forecasts for each form of fuel and energy supply. Fuel demand and energy use by the consuming sector are tabulated for 1972 and 1975 for the various fuel forms. The distribution of energy consumption by use sector, as projected for the years 1985 and 2000 in the ERDA-48 planning report (Secenario V), is normalized to match the consensus energy supply forecasts. The results are tabulated listing future demand for each fuel and energy form by each major energy-use category. Recent estimates of U.S. energy resources are also reviewed briefly and are presented in tables for each fuel and energy form. The outlook for fossil fuel resources to the year 2040, as developed by the Institute for Energy Analysis at the Oak Ridge Associated Universities, is also presented. ERA

N78-13577# Sandia Labs., Albuquerque, N. Mex.
SYSTEM DYNAMICS MODEL OF NATIONAL ENERGY USAGE
D. W. Sasser Dec. 1976 87 p refs
(Contract EY-76-C-04-0789)
(SAND-76-0415) Avail: NTIS HC A05/MF A01

A system dynamics model of energy usage is presented with particular application to the national level, although the model could be used at other levels with suitable modifications. The model simulates: growth in the energy usage sectors of industry, residential-commercial, transportation, and other electric utilities, and the depletion of the primary energy sources of coal, oil, natural gas, and uranium. The sectors in the model are highly coupled through numerous feedback loops which reflect the influence of each sector of the energy economy upon the others. The model is versatile in the sense that new energy technology can be introduced with minimal effort. A detailed description of the model is given, a number of examples of its application are described. ERA

N78-13578# Oak Ridge National Lab., Tenn.
CONSENSUS FORECAST OF US ELECTRICITY SUPPLY AND DEMAND TO THE YEAR 2000
J. A. Lane Feb. 1976 11 p
(Contract W-7405-eng-26)
(ORNL/TM-5370) Avail: NTIS HC A02/MF A01

Recent forecasts of total electricity generating capacity and energy demand as well as for electricity produced from nuclear energy and hydroelectric power are presented in tables and graphs to the year 2000. A forecast of the distribution of type of fuel and energy source that will supply the future electricity demand is presented. Use of electricity by each major consuming sector is presented for 1975. Projected demands, for electricity in the years 1985 and 2000, as allocated to consuming sectors, are derived and presented. ERA

N78-13579# General Electric Co., Schenectady, N. Y. Corporate Research and Development Div.
DEMONSTRATION OF AN INDUCTOR MOTOR/ALTERNATOR/FLYWHEEL ENERGY STORAGE SYSTEM Technical Quarterly Progress Report, 28 Sep. - 28 Dec. 1976
28 Dec. 1976 36 p
(Contract EY-76-C-02-4010)
(COO-4010-2; TQPR-2) Avail: NTIS HC A03/MF A01

The concept, consisting of a high-speed composite flywheel combined with an integral inductor-type motor/alternator, offers the possibility of a small, lightweight package with high energy storage capability. The basic technology demonstrated in this program have application to a number of flywheel energy storage systems. The demonstration unit has a nominal rating of 20 kVA. The program will develop a flywheel energy storage system sized for a 3000 lb battery electric van. The design and fabrication of the inductor motor/alternator/flywheel; and design and fabrication of the solid state power conditioner and control breadboard are discussed. ERA

N78-13580# Battelle Columbus Labs., Ohio.
HEAT SOURCE COMPONENT DEVELOPMENT PROGRAM Quarterly Report, Jan. - Mar. 1977
W. M. Pardue, comp. Apr. 1977 61 p
(Contract W-7405-eng-92-TAS-94)
(BMI-X-679) Avail: NTIS HC A04/MF A01

Experimental programs to develop components for advanced radioisotope heat source applications in advanced static and dynamic power conversion systems are reported. Specific components development efforts are described for improved selective and nonselective vents for helium release from the fuel containment, and and improved reentry member and an improved impact member, singly and combined. The unitized reentry-impact member is under development to be used as a bifunctional ablator. Finally, thermochemical supporting studies are described. ERA

N78-13581# Lincoln Lab., Mass. Inst. of Tech., Lexington.
PHOTOVOLTAIC POWER IN LESS DEVELOPED COUNTRIES
D. V. Smith 24 Mar. 1977 92 p refs
(Contract EY-76-C-02-4094)
(COO-4094-1) Avail: NTIS HC A05/MF A01

The potential of solar photovoltaic power in the third world (less developed countries) is analyzed. Application of irrigation systems powered by photovoltaics in Bangladesh, Chad, India, and Pakistan, plus an economic analysis of a photovoltaic-powered village in northern India indicate solar energy is competitive with the least-cost fossil-fuel alternatives. The most cost-effective method for specific geographical locations can be determined by field testing based on the case history data reported. ERA

N78-13582# Westinghouse Electric Corp., Pittsburgh, Pa.
EVALUATION OF A PHOTOVOLTAIC CENTRAL POWER STATION
D. A. McCutchan, P. F. Pittman, R. R. Ferber, G. C. Ruschak, Jr., and C. R. Chowaniec 1977 18 p ref Presented at the 39th Ann. Meeting of the Am. Power Conf., Chicago, 18-20 Apr. 1977; Sponsored by Illinois Inst. of Technology
(Contract EY-76-C-04-2744)
(CONF-770403-8) Avail: NTIS HC A02/MF A01

The solar plant consists of an array subsystem, which includes the cells and their supporting surface, a supporting structure and tracking equipment, and a power conversion subsystem, principally composed of solid state inverters and transformers. Many design variations were examined for each of these components. Since solar cells are expensive, the array design effort explored the use of lenses and mirrors to concentrate the solar radiation on the cells. Low cost solar tracking arrays were designed to increase the daily energy yield. Because the conversion efficiency of photovoltaic cells decreases with temperature, forced air and water cooling were considered in addition to natural convection cooling. The annual energy output was calculated for each plant concept in Phoenix, using the solar cell technology expected to be available in about 1990: for the silicon single-crystal cell used in the space program, a 16 percent conversion efficiency and the 1985 ERDA cost goal of 500$/k Wp (peak) for this cell (1975$) was postulated. ERA

N78-13583# General Atomic Co., San Diego, Calif.
SOLAR COLLECTOR FIELD SUBSYSTEM PROGRAM ON THE FIXED MIRROR SOLAR CONCENTRATOR Final Report, 28 Mar. - 30 Sep. 1976
G. H. Eggers 31 Dec. 1976 128 p
(Contract EY-76-C-04-0789)
(GA-A-14209-Rev) Avail: NTIS HC A07/MF A01

The preliminary design of a fixed mirror solar concentrator (FMSC) is described. A fluid loop was designed to route the heat transfer fluid from the supply system through the heat-receiver assembly and back to the source. The preliminary design includes pumps, valves, and pipe sizing and a specification of operating modes. Overall system design considerations were addressed through further development of tools to analyze heat receiver performance (with the SOLCOL code), and to calculate overall system static performance (with the SUNPOW code), which included quite detailed modeling of the FMSC and its insolation loss mechanisms. This effort is also described. A collector design was established that optimizes the energy collection under the specific insolation conditions and latitude of Albuquerque. ERA

N78-13584# Colorado School of Mines, Golden. Dept. of Geophysics.
RESEARCH ON THE PHYSICAL PROPERTIES OF GEOTHERMAL RESERVOIR ROCKS. SUMMARY REPORT ON COLLECTION OF SAMPLES OF VOLCANIC ROCKS FOR PETROPHYSICAL STUDIES
L. T. Grose 31 Aug. 1976 5 p
(Contract EY-76-S-02-2908)
(COO-2908-1; PR-1) Avail: NTIS HC A02/MF A01

Rock samples were collected from the Snake River Plain volcanic depression of Idaho, the Columbia Plateau's volcanic basin located in southeastern Washington, northeastern Oregon, and western Idaho, the Modoc volcanic province of northeastern California, the volcanic fields of south central Nevada, and the Jemez volcanic field of north central New Mexico. Strategy governing sample selection is described. From each field, 64 individual rock samples, each being several kilograms in size, were collected. ERA

N78-13585# Energy Research and Development Administration, Washington, D. C. Div. of Solar Energy.
INTERIM POLICY OPTIONS FOR COMMERCIALIZATION OF SOLAR HEATING AND COOLING SYSTEMS
Apr. 1977 71 p
(ERDA-77-62) Avail: NTIS HC A04/MF A01

The major incentive policy options available to accelerate market penetration of solar heating and cooling systems are reviewed. The policies described provide alternative methods for enhancing the impact of the solar heating and cooling demonstration program. Feasible policy designed to overcome existing barriers to commercial acceptance and market penetration are identified and evaluated. This report is divided into the following seven sections, each dealing with a key problem area relating to the widespread use of SHAC systems: economic and financial incentives; the solar energy public utility interface; legal and regulatory issues; ERDA patent policy; building codes, standards and warranties; marketing, manpower, consumer and environmental issues; and regional aspects of the incentives program. ERA

N78-13586# Oak Ridge National Lab., Tenn.
COAL TECHNOLOGY PROGRAM Progress Report, Mar. 1977
May 1977 37 p
(Contract W-7405-eng-26)
(ORNL/TM-5883) Avail: NTIS HC A03/MF A01

Subbituminous coal was hydrocarbonized at 1100 F and 300 psig in a recirculating fluidized bed. A two-dimensional pyrolysis behavior study of an eastern bituminous coal (Pittsburgh seam) indicated that swelling is significantly more pronounced at very low heating rates. Several activities in progress are related to inspection techniques for wear- and process-resistant coatings. Experimental investigations of fireside corrosion on tubing from a fluidized bed combustor have proceeded with metallographic examination and analyses of the scale formed during the test exposure. Methods for nondestructively determining remaining tube wall thickness and scale thickness were developed. Failure prevention and analysis work was aimed at several parts from a solvent refined coal plant. ERA

N78-13587# Argonne National Lab., Ill.
DEVELOPMENT OF LITHIUM/METAL SULFIDE BATTERIES AT ARGONNE NATIONAL LABORATORY: SUMMARY REPORT, 1976
Mar. 1977 38 p refs
(Contract W-31-109-eng-38)
(ANL-77-18) Avail: NTIS HC A03/MF A01

The intended applications for these high performance batteries are stationary energy storage for electric utility systems and electric vehicle propulsion. The battery cells consist of a lithium-aluminum alloys negative electrode, an FeS or FeS2 positive electrode, and a molten LiCl-KCl electrolyte, which requires an operating temperature of 400-450 C. Most of the cells tested during the year were of a prismatic design, with capacities in the range of 100-150 Ah. The development of cell fabrication techniques and the fabrication of cells, the development and fabrication of electrical feedthroughs and electrode separators, and a more general research and development effort on lithium/metal sulfide batteries are also deposited. A design study was initiated on a 6 MWh battery module for stationary energy storage. ERA

N78-13588# Middleton Associates, Toronto (Ontario).
CANADA'S RENEWABLE ENERGY RESOURCES: AN ASSESSMENT OF POTENTIAL
Peter Middleton, Ronald Argue, Robert Argue, T. Burrell, and George Hathaway Apr. 1976 528 p refs
(NP-21901) Avail: NTIS (US Sales Only) HC A23/MF A01; ERDA Depository Libraries

Rising costs of conventional, frontier, and nuclear energy production and the prospect of future shortages have prompted a resurgence of interest in alternative, renewable energy technologies. Principal sources of renewable energy (solar radiation, wind, and biomass), as well as waves, thermal gradients, and, sensible heat sources are reviewed to establish, in general terms, their significance in the Canadian context. Next, the technical characteristics, efficiency, costs, impacts, and state of the art of sixteen harnessing or conversion technologies are presented as an information base upon which to build an assessment of potential. A method of comparing the life cost of a renewable energy system to that of the likely conventional alternative is proposed and applied in cases where adequate technical and economic data are available. ERA

N78-13589# Foster Associates, Inc., Washington, D.C.
FUEL AND ENERGY PRICE FORECASTS. VOLUME 1: REPORT Final Report
R. Schantz, W. Mikutowicz, and W. Foster Apr. 1977 264 p refs Sponsored by Electric Power Research Inst. 2 Vol.
(EPRI-EA-411-Vol-1) Avail: NTIS HC A12/MF A01

Fuel and energy prices are studied over the period 1985 to 2000 in 1975 constant dollars, on a regional basis, for the United States. The major sources of energy analyzed include crude oil and major petroleum products, coal and coal-based synthetic fuels, gas, and uranium. It was stipulated that price projections were to be developed within a given set of aggregate energy and electricity demand projections. Delivered energy prices were estimated for four major end-use sectors: residential/commercial, industrial, electric utility, and transportation. Two major findings of the study are: The real prices of all sources of energy will increase over the forecast period. ERA

N78-13590# Foster Associates, Inc., Washington, D.C.
FUEL AND ENERGY PRICE FORECASTS. VOLUME 2: SCHEDULES Final Report
R. Schantz, W. Mikutowicz, and W. Foster Apr. 1977 190 p Sponsored by Electric Power Research Inst. 2 Vol.
(EPRI-EA-411-Vol-2) Avail: NTIS HC A09/MF A01

A compilation of schedules on information contained in two chapters of Vol. 1 is presented. Chapter 3 projected prices for major sources of energy, and chapter 4, inter-energy prices projected for major consuming sectors. ERA

N78-13591# Dow Chemical Co., Walnut Creek, Calif.
SODIUM-SULPHUR BATTERY SYSTEM Annual Report, 19 May 1975 - 19 May 1976
C. A. Levine 1 Nov. 1976 68 p
(Contract EY-76-C-02-2565)
(COO-2565-4; EY-66-C-02-2565) Avail: NTIS HC A04/MF A01

The development of the hollow-glass-fiber sodium-sulfur battery is described. Glass fiber quality improved greatly, and the fiber spinning and assembly machinery was made capable of more uniform operation. Impurities in the sulfur, do not appear to affect cell lifetime, while impurities in the Na are important. Corrosion products of a 316 stainless steel case are harmless to at least 75-day lifetimes. The Mg content of aluminum alloys can leach out in the catholyte, and cause cell resistance to increase. Lifetime does not seem to be a function of total current passed or current density across the fibers. On 1000-fiber, 0.5-Ah cells, over 1400 deep charge-discharge cycles were achieved in 75 days of operating life. A larger 5-Ah cell went through 130 cycles at over 80 percent depth. Cell resistance and capacity remained constant. At lesser depths of discharge, the cells lasted longer. Failure was usually in the fibers when 'dirty' Na was used, and usually just below the tubesheet when 'clean' Na was used. An updated estimate of 'cost for sale' of the bare cell is approximately $23.15 per kWh, based on 0.8 kWh cells. ERA

N78-13592# Illinois Univ., Urbana. Center for Advanced Computation.
NET ENERGY EFFECTS AND RESOURCE DEPLETION: AN ALL-OIL ECONOMY
P. S. Penner and D. Amado Apr. 1977 43 p refs
(Contract EY-76-S-02-2865)
(COO-2865-6) Avail: NTIS HC A03/MF A01

The impact over time as a resource is depleted and requires increasing inputs to produce a unit of output is examined. Focus is on oil extraction, starting with conventional onshore drilling and proceeding through offshore, secondary, and tertiary recovery techniques. A hypothetical single-fuel economy is constructed, in which the entire U.S. economy depends solely on crude petroleum for its energy supply. The net energy effect (increase in energy cost of energy) is analyzed. With constant 3% growth in GNP and no net energy effects, the economy would run out of oil in eleven years. Use of synthetic fuels is considered. ERA

N78-13593# Energy Research and Development Administration, Washington, D. C. Div. of Solar Energy.
SOLAR PROGRAM ASSESSMENT: ENVIRONMENTAL FACTORS. PHOTOVOLTAICS
Mar. 1977 65 p refs
(ERDA-77-47/3) Avail: NTIS HC A04/MF A01

The major environmental issues associated with further development of photovoltaic systems are presented and prioritized. To provide a background for this environmental analysis, the basic concepts of the technology are reviewed, as are its economic and resource requirements. The potential effects of this new technology on the full range of environmental concerns (i.e., air and water quality, biosystems, safety, social/institutional structures, etc.) then are discussed in terms of both their relative significance and possible solutions. Although the development of photovoltaics will contribute to certain environmental problems common to any construction project or energy producing technology, only those impacts unique to the solar portion of the technology is discussed in depth. Finally, an environmental work plan is presented. ERA

N78-13594# Eagle-Picher Co., Joplin, Mo. Couples Dept.
ELECTRIC VEHICLE PROPULSION BATTERIES: DESIGN AND COST STUDY FOR NICKEL/ZINC BATTERY MANUFACTURE, TASK A
1977 85 p
(Contract W-31-109-eng-38)
(ANL-K-77-3542-1) Avail: NTIS HC A05/MF A01

A 700-pound nickel--zinc battery was configured. Containing 64 individual cells, the unit was selected for minimum weight from computed packaging possibilities. Unit volume was projected to be 4.77 cubic feet. Capacity of the cells delivering 100+ volts was set at 245 ampere-hours. Selection was made primarily because of the compatibility with expressed vehicle requirements of a lower-current system. Manufacturing costs were computed for a unit using sintered positive electrodes at $86/kWh, pilot plant rate, and $78/kWh, production plant rate. Based on a lower than anticipated cost differential between sintered and nonsintered positive electrodes and certain other performance differences, the sintered electrode was chosen for the battery design. Capital expenditures for a production rate of 10,000 batteries per year are estimated to be $2,316,500. ERA

N78-13595# Compagnie Generale d'Electricite, Marcoussis (France).
IMPROVEMENTS OF ELECTROLYTE AND SEAL TECHNOLOGY FOR SODIUM-SULFUR AND SODIUM ANTIMONY TRICHLORIDE LOAD LEVELING BATTERIES Final Report
Yvon Lazennec Jun. 1977 132 p refs
(EPRI Proj. 726-1)
(EPRI-EM-413(6-77)) Avail: NTIS HC A07/MF A01

Possible procedures for manufacture of beta-alumina tubes using extrapolations of current practice were technically defined and costed. Powder from either molten-state or solid-state reaction, with tube-forming by either isostatic pressing or electrophoresis plus isostatic pressing were considered. Three sintering techniques using currently available furnaces were examined. Aluminum-alpha-alumina seals made by the proprietary thermocompression technqiue were fabricated and tested. Excellent leak-tightness, resistance to thermal cycling and corrosion resistance to polysulfides under static and electrochemical conditions were determined. However, some corrosion in the presence of sodium occurred due to silicon impurities in the aluminum. ERA

N78-13596# California Univ., Livermore. Lawrence Livermore Lab.
LITHIUM-WATER-AIR BATTERY PROJECT Progress Report
John. F. Cooper, Pamela K. Hosmer, and Oscar Krikorian 20 May 1977 10 p refs
(Contract W-7405-eng-48)
(UCID-17426-77-4) Avail: NTIS HC A02/MF A01

The energy efficiency of the aqueous electrolysis step in the proposed lithium production cell was experimentally determined. Coulombic efficiencies approach 100 percent above 0.7 kA/m2, square inch for amalgam concentrations of 1.0-1.2 at. percent Li, and for T = 21 C. Under these operating conditions, cell voltage is 3.1 V, and the overall energy efficiency is 82 + - 1 percent. The anodic dissolution of calcium in mixed NaOH-NaCl electrolytes was studied in the concentration region near (1.6 M NaOH, 0.05 M NaCl). It was found that passivation could be effectively prevented by additions of water-glass, Na2O . X(SiO2), x = 3-5. An oscillatory phenomenon was discovered where the potential of the calcium fluctuates with an amplitude of 0.4 V and a period of about 25 s. Under investigation are several new concepts for the high-energy-efficiency production of lithium and calcium metals. 4 figures. ERA

N78-13597# Bechtel Corp., San Francisco, Calif.
CONCEPTUAL DESIGN OF A BATTERY ENERGY STORAGE TEST (BEST) FACILITY
Aug. 1975 160 p refs Sponsored in part by Elec. Power Res. Inst.
(Contract W-31-109-eng-38)
(EPRI-255-TR-2; ERDA-31-109-38-2962-TR-2) Avail: NTIS HC A08/MF A01

Design criteria for a battery energy storage test facility are presented. Systems to provide for functions such as battery cooling, building heating-ventilating-air-conditioning, station auxiliary power, and safety are described. Economic and environmental factors are included. J.M.S.

N78-13598# BEST Facility Study Project Team.
NATIONAL BATTERY ENERGY STORAGE TEST (BEST) FACILITY: CONCEPTUAL DESIGN AND COST ESTIMATE
Aug. 1975 68 p refs Sponsored in part by EPRI
(Contract W-31-109-eng-38)
(EPRI-255-TR-1; ERDA-31-109-38-2962) Avail: NTIS HC A04/MF A01

The facility design recommended embodies features to provide the flexibility required to accommodate high-temperature, aqueous, and flowing electrolyte load-leveling batteries with capacities of up to 10 MWh. A computerized data acquisition and control system is recommended to provide the capability to monitor cell voltages, cell temperatures, and other system parameters. To provide the flexibility desired for interfacing the battery systems with the utility system, a modular converter is recommended. The BEST Facility testing program will require approximately 18 months for each battery system. Major emphasis of the program will be placed on assessing battery system performance during operation in the cycling modes anticipated for use by electric utilities. The testing will also include impulse testing to extend the range of tests by use of a variable synthetic load. ERA

N78-13599*# Thermo Electron Engineering Corp., Waltham, Mass.
ADVANCED THERMIONIC TECHNOLOGY PROGRAM Progress Report
Apr. 1977 21 p
(Contracts NAS3-20302; EY-76-C-02-3056)
(NASA-CR-155299; COO-3056-23; TE-4217/4220-123-77; PR-22) Avail: NTIS HC A02/MF A01 CSCL 01B

Topics include surface studies (surface theory, basic surface experiments, and activation chamber experiments); plasma studies (converter theory and enhanced mode conversion experiments); and component development (low temperature conversion experiments, high efficiency conversion experiments, and hot shell development). ERA

N78-13600# Oklahoma Univ., Norman. School of Chemical Engineering and Materials Science.
DEVELOPMENT OF WORKING FLUID THERMODYNAMIC PROPERTIES INFORMATION FOR GEOTHERMAL CYCLES; PHASE 1 Semiannual Report, 1 Sep. 1976 - 28 Feb. 1977
K. E. Starling, C. M. Sliepcevich, L. W. Fish, K. M. Goin, K. H. Aboul-Fotouh, K. H. Kumar, T. J. Lee, S. J. Milani, and K. L. Zemp 1977 26 p refs
(Contract EY-76-S-05-5249)
(ORO-5249-1) Avail: NTIS HC A03/MF A01

The following elements of research were performed: (1) the collection and processing of data for pure components; (2) the evaluation of the generalized Modified Benedict-Webb-Rubin (MBWR) equation of state for halogenated hydrocarbon saturated thermodynamic properties; (3) the determination of the pure

component parameters of the MBWR for four polar fluids; and (4) the investigation of modifications of the MBWR for improved prediction of properties of polar fluids. A primary conclusion is that the MBWR will predict properties for polar fluids with small to moderate dipole moments (less than 1.6 Debyes) but needs modification for fluids with larger moments. ERA

N78-13601# Argonne National Lab., Ill. Energy and Environmental Systems Div.

COMMERCIAL FEASIBILITY OF THERMAL STORAGE IN BUILDINGS FOR UTILITY LOAD LEVELING

J. G. Asbury, R. F. Giese, R. O. Mueller, and S. H. Nelson 1977 22 p refs Presented at 39th Ann. Meeting of the Am. Power Conf., Chicago, 18-20 Apr. 1977

(Contract W-31-109-eng-38)

(CONF-770403-14) Avail: NTIS HC A02/MF A01

The cost-effectiveness of thermal energy storage in buildings for electric utility load leveling was evaluated in four utility service areas. Storage space heating was found to be cost-effective in both of the service areas supplied by winter peaking utilities. In the two areas supplied by summer peaking utilities, the savings from storage air conditioning were only slightly greater than costs in the service area with a short cooling season, but greatly exceeded costs in the service area with a long cooling season. Storage hot water heaters were found to be cost-effective in all four service areas. The key to commercialization of thermal energy storage in buildings is the implementation of electric rates and other incentives to justify customer installation and use of the systems. ERA

N78-13602# Addis Translations International, Portola Valley, Calif.

PROPOSAL OF A HIGH-POWER MICROWAVE SOURCE USING A SUPERCONDUCTING CAVITY AS AN ENERGY STORAGE

K. Minami and I. Hayashi Oct. 1976 25 p refs Transl. into ENGLISH from Kakuyugo Kenkyu (Japan), v. 36, no. 4, Oct. 1976 p 301-316 Sponsored by ERDA Prepared for Calif. Univ., Livermore. Lawrence Livermore Lab.

(UCRL-Trans-11247) Avail: NTIS HC A02/MF A01

In the proposed system high-frequency energy is accumulated in a superconductive microwave cavity, and microwave pulses of a large output are obtained by releasing this energy within a short time. This system is inferior to the dc magnetic energy storage system because a high-frequency residual resistance is present in the superconductive cavity and the energy density is low. Nevertheless, immense microwave pulses, which cannot easily be obtained with ordinary electron tube oscillators, can potentially be obtained, and it is thought that there are possible uses in scientific experiments, such as in the field of nuclear fusion, and as pulse sources for radar. The fundamental experiments necessary to establish the basic principles, and the fundamental ideas and technical potentialities of the system are discussed. ERA

N78-13603# Sandia Labs., Albuquerque, N. Mex.

ENERGY STORAGE NEEDS FOR WIND POWER SYSTEMS

J. W. Reed 1977 20 p refs Presented at the Am. Assoc. for the Advan. of Sci. Conf., Denver, 20 Feb. 1977

(Contract EY-76-C-04-0789)

(SAND-76-9058; Conf-770210-6) Avail: NTIS HC A02/MF A01

Long term hourly wind observations at several representative U. S. locations have been used to show that a totally independent and perfectly reliable wind energy system would require an impractically large storage capacity, primarily to cover year-to-year and annual cycles of available wind energy. As reliability is allowed to decrease, a considerable reduction in storage capability is possible. This is demonstrated by statistical results for several climatic regimes. ERA

N78-13604# Sandia Labs., Albuquerque, N. Mex.

CONTROL SYSTEM FOR WIND-POWERED GENERATORS

G. J. Kroth May 1977 15 p

(Contract EY-76-C-04-0789)

(SAND-77-0287) Avail: NTIS HC A02/MF A01

An automatic control system is designed. It responds to electrical representations of data such as bearing temperature, vibration, wind velocity, turbine velocity, torque, or any other pertinent data. It responds by starting or stopping the turbine, controlling the loading, or sounding an alarm. A microprocessor-based controller capable of these functions is described. ERA

N78-13605# National Academy of Sciences - National Research Council, Washington, D. C.

SOLAR HEATING AND COOLING OF BUILDINGS: ACTIVITIES OF THE PRIVATE SECTOR OF THE BUILDING COMMUNITY AND ITS PERCEIVED NEEDS RELATIVE TO INCREASED ACTIVITY

1976 58 p

(Contract EY-76-C-02-2697)

(COO-2697-76/2) Avail: NTIS HC A04/MF A01

A description of the state of affairs existing in the private sector of the building community between mid-1974 and mid-1975 with regard to solar heating and cooling of buildings is presented. Also, information on the needs perceived by the private sector with regard to governmental actions (besides research) required to induce widespread application of solar energy for the heating and cooling of buildings is given. The information is based on surveys, data obtained at workshops, sales literature of manufacturers, symposia, and miscellaneous correspondence. Selected interests and projects of individuals and organizations are described. ERA

N78-13606# InterTechnology Corp., Warrenton, Va.

INTERTECHNOLOGY CORPORATION REPORT OF SOLAR ENERGY SYSTEMS INSTALLATION COSTS FOR SELECTED COMMERCIAL BUILDINGS

Dec. 1976 208 p

(Contract EY-76-C-02-2688)

(COO-2688-76-13) Avail: NTIS HC A10/MF A01

The installation of solar collector and thermal energy storage subsystems in specific non-residential building applications are presented. Both existing projects and those under construction were surveyed. Survey summary sheets for each project encountered are provided as a separate appendix. Subsequently, the rationale used to select the projects studied in-depth is presented. The results of each of the detailed studies are then provided along with survey summary sheets for each of the projects studied. Installation cost data are summarized and the significance of the differences and similarities between the reported projects is discussed. After evaluating the data obtained from the detailed studies, methods of reducing installation labor costs are postulated based on the experience of the study. Some of the methods include modularization of collectors, preplumbing and preinsulating, and collector placement procedures. ERA

N78-13607# Gould, Inc., Rolling Meadows, Ill. Nickel-Zinc Battery Project.

DEVELOP NICKEL-ZINC BATTERY SUITABLE FOR ELECTRONIC VEHICLE PROPULSION. TASK A: DESIGN AND COST STUDY

15 Feb. 1977 127 p refs

(Contract W-31-109-eng-38)

(ANL-K-77-3558-1; Rept-762-003-1) Avail: NTIS HC A07/MF A01

A three-month design and cost study for the use of nickel-zinc batteries in electric vehicles is presented. Battery configuration is analyzed, and expected performance is set forth. Current development problems concern component materials and capacity decline on cycling, electrolyte maintenance, and thermal characteristics. The manufacturing process is outlined, and estimates are made for cost, materials requirements, and capital needs. ERA

N78-13608*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SOME BASIC CONSIDERATIONS OF MEASUREMENTS INVOLVING COLLIMATED DIRECT SUNLIGHT

An-Ti Chai 1976 18 p refs Presented at Terrest. PV Meas. Workshop, Baton Rouge, La., 10 Nov. 1976

(Contract EX-76-A-29-1022)

(NASA-TM-74947; TR-2-6; ERDA/NASA-1022/76/5; Conf-761129-8) Avail: NTIS HC A02/MF A01 CSCL 10A

The geometry of collimators for devices or instruments

dealing with terrestrial direct sunlight is discussed. Effects of the opening angle and slope angle of a collimator on the measurements are investigated with regard to variations of turbidity and air mass. Based on this investigation, geometric dimensions for collimators and certain realistic terrestrial reference conditions are recommended for the purpose of solar cell calibration in terrestrial applications. ERA

N78-13609# Resource Planning Associates, Inc., Washington, D. C.
STATE ENERGY CONSERVATION PROGRAM SOURCEBOOK. VOLUME 1: OVERVIEW AND GUIDE
Jan. 1977 26 p
(Contract FEA-CR-04-60802-00)
(PB-271798/1; FEA/D-76/470-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 10A

Background information is presented about the state energy conservation program and instructions for using the source book in the development and preparation of state plans are provided. GRA

N78-13610# Federal Energy Administration, Washington, D. C. Office of State Energy Conservation Programs.
STATE ENERGY CONSERVATION PROGRAM SOURCEBOOK. VOLUME 2: STATE ENERGY CONSERVATION PLAN HANDBOOK
Jan. 1977 221 p
(PB-271799/9; FEA/D-76/471-Vol-2) Avail: NTIS HC A10/MF A01 CSCL 10A

Procedures to be followed in applying for financial assistance for the implementation of state plans are included in this handbook. Detailed descriptions of the required program measures and a description of additional program measures are also presented. Suggested procedures for calculating energy savings for the program measures are delineated. GRA

N78-13611# Federal Energy Administration, Washington, D. C. Office of State Energy Conservation Programs.
STATE ENERGY CONSERVATION PROGRAM SOURCEBOOK. VOLUME 3: GRANTS-IN AID MANAGEMENT HANDBOOK
Jan. 1977 38 p
(PB-271800/5; FEA/D-76/472-Vol-3) Avail: NTIS HC A03/MF A01 CSCL 10A

Procedures are presented for the administration of grants under the state energy conservation program. This handbook is designed as an aid for the states in applying for, and managing, their grant from FEA. GRA

N78-13612# Resource Planning Associates, Inc., Washington, D. C.
STATE ENERGY CONSERVATION PROGRAM SOURCEBOOK. VOLUME 4: PROGRAM MEASURES AND ABSTRACTS
Jan. 1977 259 p
(Contract FEA-CR-04-60802-00)
(PB-271801/3; FEA/D-76/473-Vol-4) Avail: NTIS HC A12/MF A01 CSCL 10A

A listing of measures that can be undertaken for conserving energy in each sector is presented. Abstracts of federal, state, local government, and private industry programs are also provided. GRA

N78-13613# Resource Planning Associates, Inc., Washington, D. C.
STATE ENERGY CONSERVATION PROGRAM SOURCEBOOK. VOLUME 6: BIBLIOGRAPHY
Jan. 1977 62 p
(Contract FEA-CR-04-60802-00)
(PB-271802/1; FEA/D-76/475-Vol-6) Avail: NTIS HC A04/MF A01 CSCL 10A

Abstracts of some available energy conservation publications are provided along with references to other publications. GRA

N78-13614# National Governors' Conference, Washington, D. C. Subcommittee on Energy Conservation.
FEDERAL ENERGY CONSERVATION PROGRAMS, A STATE PERSPECTIVE
Connie B. Q. Laughlin May 1977 50 p refs refs
(PB-271283/4; NATGOV-77/03071) Avail: NTIS HC A03/MF A01 CSCL 10A

The implementation of energy conservation programs mandated by the Energy Conservation and Production Act and the Energy Policy and Conservation Act is examined. The report concludes that state energy conservation efforts are hampered by the fragmentation of federal programs among a number of different agencies. The programs also lack the flexibility needed in light of differing needs and capabilities within the states. GRA

N78-13615# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
SOLAR ENERGY DEHUMIDIFICATION EXPERIMENT ON THE CITICORP CENTER BUILDING Final Report
Jun. 1977 175 p refs
(Grant NSF PTP-75-05156)
(PB-271174/5; MIT-EL-77-005; NSF/RA-760003) Avail: NTIS HC A08/MF A01 CSCL 13A

The technical and economic feasibility of using solar energy to reduce conventional energy consumption of a large urban commercial building were studied. Specifically, solar assisted dehumidification of ventilation air to reduce conventional air conditioning requirements for the Citicorp Center in New York City was investigated. A detailed computer simulation of yearly operation was made on an hourly basis using New York City temperature, humidity and solar data. Several system configurations were examined and were defined, each operating in its most efficient fashion. GRA

N78-13616# Oklahoma Univ., Norman. Science and Public Policy Program.
ENERGY FROM THE WEST: A PROGRESS REPORT OF A TECHNOLOGY ASSESSMENT OF WESTERN ENERGY RESOURCE DEVELOPMENT. VOLUME 1: SUMMARY REPORT Final Report, Jul. 1975 - Mar. 1977
Irvin L. White, Michael A. Chartock, R. Leon Leonard, Steven C. Ballard, and Martha W. Gilliland Jun. 1977 185 p refs
(Contract EPA-68-01-1916)
(PB-271752/8; EPA-600/7-77-072a-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 08I

The development of six energy resources in eight western states during the period from the present to the year 2000 was studied. The purpose and conduct of the study are described, and results of the analyses conducted during the first year are summarized. Plans for the remainder of the project are outlined. GRA

N78-13617# Oklahoma Univ., Norman. Science and Public Policy Program.
ENERGY FROM THE WEST: A PROGRESS REPORT OF A TECHNOLOGY ASSESSMENT OF WESTERN ENERGY RESOURCE DEVELOPMENT. VOLUME 2: DETAILED ANALYSIS AND SUPPORTING MATERIALS Final Report, Jul. 1975 - Mar. 1977
Irvin L. White, Michael A. Chartock, R. Leon Leonard, Steven C. Ballard, and Martha W. Gilliland Jun. 1977 842 p refs
(Contract EPA-68-01-1916)
(PB-271753/6; EPA-600/7-77-072b-Vol-2) Avail: NTIS HC A99/MF A01 CSCL 08I

A progress report is presented of a three year technology assessment of the development of six energy resources in eight western states. Detailed analytical results are provided along with an analysis of the likely impacts of deploying typical energy resource development technologies at sites representative of the kinds of conditions likely to be encountered in the eight state study area. The impacts likely to occur if western energy resources are developed at three different levels from the present to the year 2000 were also examined. GRA

N78-13618# Oklahoma Univ., Norman. Science and Public Policy Program.
ENERGY FROM THE WEST: A PROGRESS REPORT OF A TECHNOLOGY ASSESSMENT OF WESTERN ENERGY RESOURCE DEVELOPMENT. VOLUME 3: PRELIMINARY POLICY ANALYSIS Final Report, Jul. 1975 - Mar. 1977
Irvin L. White, Michael A. Chartock, R. Leon Leonard, Steven C. Ballard, and Martha W. Gilliland Jun. 1977 194 p refs

(Contract EPA-68-01-1916)
(PB-271754/4; EPA-600/7-77-072c-Vol-3) Avail: NTIS HC A09/MF A01 CSCL 08I

The political and institutional context of policymaking for western energy resource development is described, and a detailed discussion of selected related problems and issues is presented. GRA

N78-13619# Oklahoma Univ., Norman. Science and Public Policy Program.
ENERGY FROM THE WEST: A PROGRESS REPORT OF A TECHNOLOGY ASSESSMENT OF WESTERN ENERGY RESOURCE DEVELOPMENT. VOLUME 4: APPENDICES Final Report, Jul. 1975 - Mar. 1977
Irvin L. White, Michael A. Chartock, R. Leon Leonard, F. Scott Lagrone, and C. Patrick Bartosh Jul. 1977 219 p refs
(Contract EPA-68-01-1916)
(PB-272243/7; EPA-600/7-77-072d-Vol-4) Avail: NTIS HC A10/MF A01 CSCL 08I

This progress report presents two appendices on air quality modeling and energy transportation costs. GRA

N78-13620# Energy Research and Development Administration, Washington, D. C.
PROCEEDINGS OF A SEMINAR ON INTERNATIONAL ENERGY
1975 228 p Seminar held at Washington, D. C., 9-10 Jun. 1975 Prepared in cooperation with NSF, and R and D Assoc., Marina Del Rey, Calif.
(ERDA-79) Avail: NTIS HC A11/MF A01

The following issues were discussed: identifying policy problems, developing options, clarifying the issues, understanding the possible consequences of actions, and making the information available to the policymakers. Separate abstracts are included here for the three sessions: Policy issues of Concern to Government Decision-Makers, Analytical Capabilities; and Information Needs and Availability. The discussions following each session are included after the formal presentations. ERA

N78-13621# Puerto Rico Water Resources Authority, San Juan. Electrical Planning and Research Div.
IMPACT OF SOLAR HEATING AND COOLING ON ELECTRIC UTILITIES Final Report
Nestor R. Ortiz, Rafael Lavina, Jr., Jesus A. Sanchez, Wenceslao Torres, and Jose A. Intron 29 Dec. 1976 92 p
(Grant NSF APR-75-18301)
(PB-271415/2; NSF/RA-760595) Avail: NTIS HC A05/MF A01 CSCL 13B

The possible effect of solar heating and cooling systems on the base load, peak demand, generating system, transmission system, and financial structure of the Puerto Rico Water Resources Authority was investigated. Heating and cooling loads were defined in terms of their number, their energy consumption, and their load pattern. Estimates of their load were validated through load survey measurments on a selected statistical sample. The effect of solar heating and cooling on the utility was found to be of minor significance although a revision of the existing rate structure would be required within three or four years. GRA

N78-13622# Utah Univ., Salt Lake City.
GEOPHYSICS APPLIED TO DETECTION AND DELINEATION OF NON-ENERGY NON-RENEWABLE RESOURCES: WORKSHOP ON MINING GEOPHYSICS
S. H. Ward, R. Campbell (US Steel Corp., Pittsburgh), J. D. Corbett (Cities Serv. Minerals Corp.), G. W. Hohmann (Kennecott Exploration, Inc.), C. K. Moss (ASARCO, Inc.), and P. M. Wright (Bear Creek Mining Co.) Mar. 1977 314 p refs Workshop held at Salt Lake City, 6-8 Dec. 1976
(Grant NSF AER-76-80802)
(PB-271952/4; NSF/RA-770173) Avail: NTIS HC A14/MF A01 CSCL 08I

The needs for research in mining geophysics related to nonenergy, nonrenewable resources were explored. Participants included mining geophysicists who were concerned with exploration of base metals. State of the art reports were presented in the areas of induced polarization, resistivity, and self-potential methods; electromagnetic methods; remote sensing methods; nuclear methods, and case histories. A list of high priority research items was compiled. GRA

N78-13623# NATO Committee on the Challenges of Modern Society, Brussels (Belgium).
CCMS SOLAR ENERGY PILOT STUDY: REPORT OF THE ANNUAL MEETING
Redfield W. Allen (Maryland Univ., College Park) and Sheila Blum (Maryland Univ., College Park) May 1977 223 p Meeting held at Copenhagen, 13-15 Sep. 1976 Sponsored in part by ERDA
(PB-271797/3; NATO/CCMS-54) Avail: NTIS HC A10/MF A01 CSCL 10A

Presentations made by representatives of participating countries are reported. National solar heating and cooling programs were described and summaries of special reports prepared during 1976 in accordance with the CCMS system reporting format were presented as were previews of upcoming projects. Summaries of major topics covered during the general discussion session are also included, as are additional sections on pilot study activities. GRA

N78-13624# Bureau of Mines, Pittsburgh, Pa. Mining and Safety Research Center.
GEOLOGY AND GAS CONTENT OF COALBEDS IN VICINITY OF BUREAU OF MINES, BRUCETON, PA. Report of Investigations, 1977
Curtis H. Elder and Meherwan C. Irani 1977 28 p refs
(PB-271875/7; BM-RI-8247) Avail: NTIS HC A03/MF A01 CSCL 08I

Degasification test boreholes drilled to depths of 1,238 and 1,212 feet on Bureau of Mines property at Bruceton, Pa. provided detailed geologic information and geologic sections that were correlated with regional stratigraphic cross-sections prepared by the Pennsylvania Geological Survey. Gas content determinations and coal analyses were made on the Upper Freeport, Middle Kittanning, Clarion, Brookville, and Mercer coalbeds. Gas content of the coalbeds ranged from 53 to 165 cu ft per ton. Formation pressure and gas flow tests were conducted on selected coalbed intervals in borehole No. 1. Formation pressures ranged from 292 to 473 psig. The Middle Kittanning coalbed was hydraulically stimulated using very heavy gelled water. Gas production remained low owing to gel residue and formation water inhibiting the flow of gas. Gas contents in Clarion, Upper Brookville, and Mercer coalbeds were anomalously low owing to proximity of porous sandstones that act as reservoirs for gas migrating home coalbeds. GRA

N78-13262*# Argonne National Lab., Ill.
COAL FEED COMPONENT TESTING FOR CDIF
C. Victor Pearson, Burton K. Snyder, and Thomas E. Fornek *In* JPL Proc. of the Conf. on Coal Feeding Systems 15 Sep. 1977 p 550-570 (For availability see N78-13241 04-31)
Avail: NTIS HC A99/MF A01 CSCL 10B

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N78-13625 Rutgers - The State Univ., New Brunswick, N. J.
THE PHYSICAL IMPACT OF THERMAL DISCHARGES ON THE ESTUARINE ENVIRONMENT Ph.D. Thesis
Vishakh B. Mantri 1977 339 p
Avail: Univ. Microfilms Order No. 77-17551

The physical impact of thermal discharges on the Delaware River estuary was analyzed. The analysis includes detailed attention to various transport phenomena. One and two dimensional models have been developed to simulate hydrodynamics and temperature distribution in the estuary. The one dimensional model has been verified using prototype data for the Delaware River estuary between Trenton, New Jersey, and Wilmington, Delaware. The two dimensional model is solved by the modified ADI method to yield velocity and temperature distribution in vertical direction. Results of the two dimensional model are used to evaluate thermal dispersion coefficients for the Delaware River estuary.

The one dimensional model is also used to evaluate exchange coefficients and equilibrium temperatures for a particular period. The excess evaporation due to thermal loads is evaluated using results obtained by the one dimensional model. Dissert. Abstr.

N78-13626 California Univ., Berkeley.
CHEMICAL ASPECTS OF GROUND WATER RECHARGE WITH WASTEWATERS Ph.D. Thesis
Larry Lee Russell 1976 425 p
Avail: Univ. Microfilms Order No. 77-15842

Chemical interactions in the wastewater-soil system and their effects on recharge water quality were investigated. A key interaction in the wastewater-soil system was emphasized, which involves nitrification and its role in soil dissolution. It was found that percolant water quality can be degraded substantially more if nitrification occurs on the soil rather than in a wastewater treatment plant. Dissert. Abstr.

N78-13627 Minnesota Univ., Minneapolis.
PARAMETRIC MEASUREMENT OF SUBMICRON ATMOSPHERIC AEROSOL SIZE DISTRIBUTIONS Ph.D. Thesis
George Michael Sverdrup 1977 314 p
Avail: Univ. Microfilms Order No. 77-19042

A parametric measurement method for determining size distributions of submicron atmospheric aerosols is presented. This method consists of continuously monitoring three integral aerosol parameters and the ambient relative humidity, and then inverting these data to recover the three weightings (i.e., number, surface, volume) of the aerosol size distribution. Dissert. Abstr.

N78-13628*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
QUANTITATIVE ANALYSIS OF AIRCRAFT MULTISPECTRAL-SCANNER DATA AND MAPPING OF WATER-QUALITY PARAMETERS IN THE JAMES RIVER IN VIRGINIA
Robert W. Johnson and Gilbert S. Bahn (Vought Corp., Hampton, Va.) Dec. 1977 33 p refs
(NASA-TP-1021; L-10968) Avail: NTIS HC A03/MF A01 CSCL 13B

Statistical analysis techniques were applied to develop quantitative relationships between in situ river measurements and the remotely sensed data that were obtained over the James River in Virginia on 28 May 1974. The remotely sensed data were collected with a multispectral scanner and with photographs taken from an aircraft platform. Concentration differences among water quality parameters such as suspended sediment, chlorophyll a, and nutrients indicated significant spectral variations. Calibrated equations from the multiple regression analysis were used to develop maps that indicated the quantitative distributions of water quality parameters and the dispersion characteristics of a pollutant plume entering the turbid river system. Results from further analyses that use only three preselected multispectral scanner bands of data indicatead that regression coefficients and standard errors of estimate were not appreciably degraded compared with results from the 10-band analysis. Author

N78-13629# Illinois Inst. for Environmental Quality, Chicago.
ECONOMIC IMPACT OF A PROPOSED CHANGE IN THE AMMONIA EFFLUENT STANDARDS, RR-6 Final Report
Linda Huff Jun. 1977 94 p refs Sponsored by EPA, Chicago
(PB-270992/1; IIEQ-77-18) Avail: NTIS HC A05/MF A01 CSCL 13B

A regulatory proposal pertaining to enforcement of the existing ammonia water quality standard was evaluated regarding the potential economic impact on society and the environment. The Illinois Environmental Protection Agency (IEPA) presented regulation exceptions due to technological and economic hardships. The IEPA proposed modification pertains to those areas of small or intermittent streams which are ammonia water quality limited, exempting small dischargers and obtaining a two year delay for larger dischargers in their installation of nitrification facilities with an additional two years for technological development. GRA

N78-13630# Monsanto Research Corp., Dayton, Ohio.
APPLICATION OF FOAM SCRUBBING TO FINE PARTICLE CONTROL, PHASE 2 Final Report, Jul. 1975 - Jul. 1976
T. E. Ctvrtnicek, S. J. Rusek, C. M. Moscowitz, and L. N. Cash Jun. 1977 77 p refs
(Contract EPA-68-02-1453)
(PB-271020/0; MRC-DA-682; EPA-600/2-77-110) Avail: NTIS HC A05/MF A01 CSCL 13B

The knowledge, experience, and data gained to date were summarized, relative to the application of foam scrubbing to collection of fine particles from gaseous streams. Experimental data obtained on a 0.236-cu m/s pilot-scale foam scrubber facility were presented. Economic analysis indicated that a foam scrubber can be competitive with other fine particle collection devices. Areas for further foam scrubber development are recommended. GRA

N78-13631# Environmental Protection Agency, Ann Arbor, Mich. Mich. Standards Development and Support Branch.
FORD-EPA EMISSION LABORATORY CORRELATION STUDY
Apr. 1976 27 p
(PB-270699/2; CORR-76-2) Avail: NTIS HC A03/MF A01 CSCL 14B

A specific emissions correlation program between the EPA vehicle Emission Laboratory and the Ford Motor Company AEO facility was completed. Examination of the Ford mass simulator results, gas cross check results, and emission and fuel economy comparisons do not indicate any serious correlation problem between laboratories. GRA

N78-13632# Environmental Protection Agency, Ann Arbor, Mich. Mich. Standards Development and Support Branch.
EPA-BMW CORRELATION PROGRAM
May 1975 12 p
(PB-270559/8; CORR-75-2) Avail: NTIS HC A02/MF A01 CSCL 14B

Exhaust emission and gas cylinder analysis data were gathered at the EPA laboratory and at the new BMW test facility in Farmington. The laboratories agreed closely in the measurement of CO. Although there were significant differences in the measured levels of HC, NOx, and CO2, it is believed that these discrepancies were caused by differences in dynamometer type and ambient conditions. Because of the limited amount of testing done, it was not possible to generate ambient correlation factors for the exhaust emissions. GRA

N78-13633# Environmental Protection Agency, Ann Arbor, Mich. Standards Development and Support Branch.
TYPICAL VEHICLE DIURNAL
Gary M. Wilson and Thomas Rarick Oct. 1976 62 p refs
(PB-270690/1; EVAP-76-3) Avail: NTIS HC A04/MF A01 CSCL 13B

Fuel evaporative emissions, as a result of the daily range in temperature to which the fuel tank is exposed, were studied. Evaporative diurnal losses were simulated by artificially heating the fuel tank over a one hour period, such that the tank fuel underwent a temperature excursion from 60 to 84 F. An evaluation of the differences between a real life diurnal and a simulated test procedure was made using data gathered from an instrumented fuel tank. The mechanisms involved in the evolution of hydrocarbon vapors from a vehicle fuel tank were of primary concern. GRA

N78-13634# Environmental Protection Agency, Ann Arbor, Mich. Standards Development and Support Branch.
TEST PROCEDURE ANALYSIS AND RECOMMENDATIONS FOR SUPERSONIC TRANSPORT AIRCRAFT EMISSION MEASUREMENT
Gary F. Austin Nov. 1976 68 p
(PB-270864/2; AC-76-03) Avail: NTIS HC A04/MF A01 CSCL 14B

An analysis is provided of two techniques for the measurement of exhaust emissions from afterburning engines. The Air Force plume method, where emission levels are determined downstream of the exhaust, was offered as the preferred method. The near plume method, where emission levels are determined at the exhaust nozzle, was found to be an acceptable alternative in limited area test environments. GRA

N78-13635# Radian Corp., Austin, Tex.
ANALYSIS OF RANDOM ERRORS IN AIR-QUALITY MEASUREMENTS Final Report
Hugh J. Williamson, Otto M. Friedrich, and Joe D. Stuart Jun. 1977 77 p refs
(Contract EPA-68-02-1383)
(PB-270555/6; RAD-77-100-044-16-07; EPA-906/9-77-005) Avail: NTIS HC A05/MF A01 CSCL 14B

An analysis was performed of the random errors involved in measurements of ozone, SO2, NO, and NOx made with Radian-built air monitoring trailers. Differences observed between 'known' test gas concentrations and the corresponding machine responses were used to quantify the error properties. Data obtained through quality assurance audits, performed both by EPA and Radian, and through daily autocalibrations of the instrumentation were analyzed. GRA

N78-13636# Radian Corp., Austin, Tex.
A QUALITY ASSURANCE PROGRAM FOR MONITORING OZONE AND CARBON MONOXIDE Final Report
David C. Jones and Louis H. Fowler Jun. 1977 108 p refs
(Contract EPA-68-02-1383)
(PB-271204/0; RAD-TN-100-044-16; EPA-906/9-77-003) Avail: NTIS HC A06/MF A01 CSCL 14B

A quality assurance program for monitoring ozone and carbon monoxide is described, which uses a chemiluminescent ozone monitor and a nondispersive infrared CO monitor. Instrument selection criteria and site selection criteria are presented. Step by step procedures are given discussing routine station operation, instrument multipoint calibrations, and quality assurance audits. Record keeping procedures, data reduction and data handling are discussed. GRA

N78-13637# Stanford Research Inst., Menlo Park, Calif.
MASTER DATA FILE FROM THE SUMMER 1975 NORTHEAST OXIDANT TRANSPORT STUDY. USERS MANUAL
Ronald E. Ruff, Leonard S. Gasiorek, and Shigeishi Hisao Jun. 1977 50 p
(Contract EPA-68-01-2940)
(PB-271287/5; EPA-901/9-76-004; EPA-DF-77/007a) Avail: NTIS HC A03/MF A01 CSCL 13B

Data from the Northeast Oxidant Transport Study were collected, validated and compiled. The final product is a comprehensive data base stored on a single reel of magnetic tape. The content and format of this magnetic tape are described. Both air quality and meteorological data, from ground stations and aircraft, are included. Different geographical areas throughout the Northeast were covered by four aircraft. Ground station data are included for Massachusetts, New York, New Jersey, Connecticut and Rhode Island. GRA

N78-13638# Environmental Sciences Research Lab., Research Triangle Park, N.C.
REGIONAL TRANSPORT AND TRANSFORMATION OF SULFUR DIOXIDE TO SULFATES IN THE UNITED STATES
A. P. Altshuller Jun. 1977 59 p refs
(PB-271927/6) Avail: NTIS HC A04/MF A01 CSCL 04A

Trends in and relationships between ambient air SO2 and sulfate concentrations at 48 urban and 27 nonurban sites throughout the United States between 1963 and 1974 were analyzed. Large decreases in SO2 concentrations at urban sites in the eastern and midwestern United States were accompanied by modest decreases in sulfate concentrations. Large variations in SO2 emissions among air quality control regions also resulted in much smaller variations in sulfate concentrations. Large changes in the patterns of SO2 emissions had little impact on sulfate concentrations in most air quality regions. GRA

N78-13639# GCA Corp., Bedford, Mass.
EMISSION DENSITY ZONING Final Report
Frank H. Renesh, Phillip D. McLellan, Michael T. Mills, and Robert Patterson Mar. 1977 192 p refs
(Contract EPA-68-02-1376)
(PB-271892/2; GCA-TR-77-01-G; EPA-450/3-77-006) Avail: NTIS HC A09/MF A01 CSCL 13B

An air quality control strategy is described whereby all parcels of land within an air quality maintenance area are assigned maximum legal emission allowances for particulate matter and sulfur oxides, expressed in terms of mass of pollutant per time period per lot area. Subjects include the development of criteria for (a) partitioning an air quality maintenance area (b) the setting of emission density limits and (c) the revision of the emission density limits as conditions change. The criteria are then translated into a linear program. The criteria and model were tested in Baltimore and Louisville. GRA

N78-13640# Civil and Environmental Engineering Development Office, Tyndall AFB, Fla. Detachment 1 ADTC.
AIR QUALITY IMPACT OF AIRCRAFT AT 10 USAF BASES Final Report, 25 Sep. 1976 - 15 Mar. 1977
Dennis F. Naugle, Bradford C. Grems, III, and Peter S. Daley Apr. 1977 18 p refs
(AD-A045464; CEEDO-TR-76-23) Avail: NTIS HC A02/MF A01 CSCL 13/2

The contributions of Air Force aircraft to ambient air quality at 10 major bases were predicted from operational data using a computerized Gaussian dispersion technique. Annual arithmetic mean concentrations are presented for common air pollutants. The predictions are well below National Ambient Air Quality Standards for those pollutants with standards specified as annual averages. Hourly worst case predictions were converted to Pollutant Standards Index (PSI) values. Aircraft sources produced average PSI values of 4.9 for nitrogen dioxide, 2.1 carbon monoxide, 1.9 for total suspended particulates, and 1.4 for sulfur dioxide. The PSI scale ranges from 0 to 500 with 100 designated as the level above which health effects may occur. A PSI for hydrocarbons could not be computed since direct health effects have not been observed and indirect effects through oxidant formation could not be predicted within the scope of this analysis. The relative significance of pollutants emitted by AF aircraft indicated by this report is (from most significant to least significant): hydrocarbons, oxides, or nitrogen, particulate matter, carbon monoxide, and sulfur oxides. This ordering can be used as a guide to future engine design priorities and control strategy development. GRA

N78-13641# Argonne National Lab., Ill.
ANL/HIWAY: AN AIR POLLUTION EVALUATION MODEL FOR ROADWAYS
George A. Concaildi, Alan S. Cohen, and Richard F. King Dec. 1976 145 p refs Prepared in cooperation with Chicago Univ., Ill.
(Contract W-31-109-eng-38; Grants NSF AG-352; NSF GI-32989)
(ANL-76-XX-37) Avail: NTIS HC A07/MF A01

A computer program, called ANL/HIWAY, for estimating air quality levels of nonreactive pollutants produced by vehicular sources is described. It is valid for receptors at distances of tens to hundreds of meters, at an angle, downwind of the roadway, in relatively uncomplicated terrain. It may be used by planners to analyze the effects of a proposed roadway on adjacent air quality. The ANL/HIWAY model expands the evaluation capabilities of the EPA/HIWAY dispersion model. This report also serves as a user's manual for running the ANL/HIWAY PROGRAM. All command structures are described in detail, with sample problems exemplifying their use. ERA

N78-13642# Battelle Pacific Northwest Labs., Richland, Wash.
SIMILARITY INDICES. 2: THE POWER OF GOODALL'S SIGNIFICANCE TEST FOR THE SIMPLE MATCHING COEFFICIENT. ADDENDUM
J. W. Johnston Dec. 1976 42 p refs
(Contract EY-76-C-06-1830)
(BNWL-2152-Add-2; NRC-1-Add-2) Avail: NTIS HC A03/MF A01

The simple matching coefficient, K/sub SM/, of Sokal and Michener is representative of a class of coefficients used to indicate the degree of similarity between two multivariate samples from ecological communities. Goodall proposed a statistical decision rule based on K/sub SM/ for deciding whether or not the degree of similarity was small enough to allow the conclusion that the two samples come from different populations. It is shown that the statistical power of Goodall's test was only 0.42 when a 95 percent confidence level test and a reasonable alternative were used. When a 0.05 chance was allowed for making the

error of concluding that the two communities were different, when in fact they were the same, then there was less than a 50-50 chance (0.42-0.58) of concluding that the two samples were different when the samples were constructed to be different. ERA

N78-13643# Los Alamos Scientific Lab., N. Mex.
AEROSOL SAMPLING AND CHARACTERIZATION FOR HAZARD EVALUATION Progress Report, 1 Jul. 1975 - 30 Sep. 1976
Ronald C. Scripsick, Douglas C. Gray, Marvin I. Tillery, Ronald G. Stafford, and Pablo O. Romero Apr. 1977 23 p refs
(Contract W-7405-eng-36)
(LA-6777-PR) Avail: NTIS HC A02/MF A01

A system for estimating dissolution rates of plutonium aerosols was developed. Studies indicate that plutonium aerosols found in the field have a rapid initial dissolution phase followed by a slower secondary phase. Three methods of particle sizing air samples collected on membrane filters were investigated. The most promising was a scanning electron microscope electron microprobe (SEM-EMp) method. An operating plutonium handling facility was a model for development of techniques to evaluate aerosol surveillance systems performance. Airborne contamination records were studied. The physicochemical properties of a plutonium aerosol existing in the facility were investigated in relation to plutonium handling operations. The techniques developed have indicated some areas of the aerosol surveillance system that need improvement. ERA

N78-13644# Union Carbide Corp., Oak Ridge, Tenn. Nuclear Div.
PATHWAYS OF TRACE ELEMENTS IN THE ENVIRONMENT
Richard J. Raridon 1977 19 p refs Presented at Assoc. Acad. Sci. Advan. of Sci. Conf., Denver, 21 Feb. 1977
(Contract W-7405-eng-26)
(CONF-770210-3) Avail: NTIS HC A02/MF A01

Applications of computer models for air transport (ATM) and hydrologic transport (HTM) to determine the pathways of trace elements, in the environment are discussed. Computed data and measured data are compared for potentially toxic contaminants found in gaseous wastes from fossil-fuel power plants. It is pointed out that meteorological data are required for the air transport model and that for each source it is necessary to know the emission rate, source height, and location relative to the receptor point. Results of studies on ground level SO2 concentrations as a function of distance from a proposed fossil-fuel power plant, the environmental impact of an existing power plant on its surroundings, and in monitoring a 98 hectare watershed for nutrient elements (K, Na, Ca, Mg, N, and P) are discussed. ERA

N78-13645# Research Corp. of New England, Wethersfield, Conn.
TIME-VARIABLE AIR POLLUTANT EMISSION STRATEGIES FOR INDIVIDUAL POWER PLANTS Final Report
Glenn R. Hilst, Richard J. Londergan, and Thomas G. Hopper Apr. 1977 51 p refs
(Grant NSF AEN-75-15168; Proj. 487-1)
(EPRI-EA-418) Avail: NTIS HC A04/MF A01

A basis is provided for the evaluation of the feasibility, operational characteristics, and potential cost savings of sophisticated time-variable emissions control systems. Emphasis is on SO2 emissions from a fossil-fuel power plant. The study utilizes two years of data from a site in the Northern Great Plains region. The data are applied to models for defining and evaluating time histories of pollutant emissions which satisfy all relevant air quality standards and minimize the operational costs of emissions control. Under conservative assumptions as to plant size, effective stack height. The potential for significant cost savings is shown through the use of time variable emissions control systems. ERA

N78-13646# Argonne National Lab., Ill.
ECONOMETRIC MODEL OF INTRAURBAN LOCATION OF EMITTERS AND RECEPTORS OF INDUSTRIAL AIR POLLUTION
D. J. Santini and R. Braid Feb. 1977 128 p refs
(Contract W-31-109-eng-38)
(ANL-77-XX-70) Avail: NTIS HC A07/MF A01

An econometric model of air pollution for an intraurban location (the Chicago area) is constructed and estimated. Exogenous variables are selected to represent transportation infrastructure investments resulting primarily from federal and state decisions. The exogenous variables account for the relative services provided by highways, commuter railroads, rail rapid transit, waterways, and airports. The employment location equations indicate that waterway availability constrains the locational options of most major industrial air polluters; that highway accessibility is a more influential factor in industrial than services location choices; that rail rapid transit accessibility is more important to services than industrial locations; and that major airports attract light industrial development. The success of the employment location equations reflects the importance of disaggregating intraurban modes of transport and of adding to urban location models the local effects of interurban modes of transport such as water and air. ERA

N78-13647# KVB Engineering, Inc., Tustin, Calif.
EFFECT OF SMOKE AND CORROSION SUPPRESSANT ADDITIVES ON PARTICULATE AND GASEOUS EMISSIONS FROM A UTILITY GAS TURBINE Final Report
J. F. Hurley and S. Hersh Mar. 1977 114 p refs
(EPRI Proj. 462-1)
(EPRI-FP-398) Avail: NTIS HC A06/MF A01

The use of metallic based fuel additives, to suppress visible exhaust smoke and inhibit hot section corrosion in electric utility gas turbines, was explored. A comprehensive field test program was undertaken to assess the effects of these additives on overall turbine cycle performance, exhaust total particulate mass loading and composition, particle size distribution, size and chemical state of the emissions derived from the additive base element, polycyclic organic matter and gaseous emissions. Test results show that at base load the decrease in utility turbine exhaust plume opacity with additive injection rate is primarily due to a reduction in carbonaceous emission. ERA

N78-13648# National Oceanic and Atmospheric Administration, Washington, D. C. Marine Assessment Div.
ANALYSIS OF BRINE DISPOSAL IN THE GULF OF MEXICO. 3: CAPLINE SECTOR
Charles A. Burroughs, ed. May 1977 201 p refs
(Contract FEA-CG-13-70040-00)
(PB-271292/5; NOAA-77072523) Avail: NTIS HC A10/MF A01 CSCL 13B

As proposed by the Federal Energy Administration, storage caverns for crude oil will be leached out of salt domes along the Capline Sector of the Louisiana Coast. The saturated brine produced as the caverns are solution mined will be disposed of in the Gulf of Mexico. The potential environmental impact of this disposal is reported and an extensive summary was made of physiographic, meteorological, and oceanographic conditions of the Capline Sector. A comprehensive review is included of ecological conditions of the area. GRA

N78-13649# Hydrocomp, Inc., Palo Alto, Calif.
SIMULATION OF NUTRIENT LOADINGS IN SURFACE RUNOFF WITH THE NPS MODEL Final Report
Anthony S. Donigan, Jr. and Norman H. Crawford Jun. 1977 123 p refs
(Contract EPA-R-803315-01-2)
(PB-270967/3; EPA-600/3-77-065) Avail: NTIS HC A06/MF A01 CSCL 13B

The NPS Model simulates all nonpoint pollutants as a function of sediment loss. The key question was whether sediment is a reliable indicator of nutrients in surface runoff. Both literature surveyed and the results of this work indicate total nitrogen (N) and total phosphorus (P) can be reasonably simulated in this manner. Also organic components of N and P can be simulated since they are generally associated with sediment and comprise a major portion of the total nutrients in surface runoff. GRA

N78-13650# IIT Research Inst., Chicago, Ill.
CYANIDE REMOVAL FROM PETROLEUM REFINERY WASTEWATER USING POWDERED ACTIVATED CARBON Final Report, Sep. 1975 - Feb. 1977

James E. Huff and Jeffrey M. Bigger Jun. 1977 110 p refs Sponsored by EPA Prepared in cooperation with Ill. Inst. for Environ. Quality, Chicago.
(PB-270862/6; IIEQ-77-08) Avail: NTIS HC A06/MF A01 CSCL 13B

The feasibility of using powered activated carbon (PAC) and cupric chloride for removal of cyanide in refinery wastewaters was investigated. GRA

N78-13651# Environmental Monitoring and Support Lab., Research Triangle Park, N. C. Quality Assurance Branch.
SURVEY OF CONTINUOUS SOURCE EMISSION MONITORS: SURVEY NO. 1: NOx AND SO2 Final Report
Michael C. Osborne and M. Rodney Midgett Apr. 1977 45 p refs
(PB-270959/0; EPA-600/4-77-022) Avail: NTIS HC A03/MF A01 CSCL 13B

The accuracy and reliability of continuous monitors which have been on-line for six months or longer were evaluated. Only extractive monitors installed in power plants, sulfuric acid plants, and smelters were included in the survey. The plan involved sending NBS-traceable gas cylinders of varying concentrations of SO2 or NO to the participating industries and introducing them into the monitoring systems. Results revealed that less than half of the monitors failed to achieve a performance accuracy of + 10 percent. GRA

N78-13652# Kentucky Water Resources Research Inst., Lexington.
SIMULATION OF THE SEDIMENTOLOGY OF DETENTION BASINS
A. J. Ward, C. T. Haan, and B. J. Barfield Jun. 1977 143 p refs
(Contract DI-14-34-0001-6081)
(PB-270611/7; RR-103; W77-10185; OWRT-B-046-KY(1)) Avail: NTIS HC A07/MF A01 CSCL 13B

A mathematical model for describing the sedimentation characteristics of detention basins was developed. This model requires as inputs the inflow hydrograph, inflow sediment graph, sediment particle size distribution, detention basin stage-area relationship and detention basin stage-discharge relationship. Based on this information, the model routes the water and sediment through the basin. The outflow sediment concentration graph, the pattern of sediment deposition in the basin and the sediment trapping efficiency are estimated. GRA

N78-13653# Battelle Pacific Northwest Labs., Richland, Wash.
STRAM: AN AIR POLLUTION MODEL INCORPORATING NONLINEAR CHEMISTRY, VARIABLE TRAJECTORIES, AND PLUME SEGMENT DIFFUSION Final Report
J. M. Hales, D. C. Powell, and T. D. Fox Apr. 1977 158 p refs
(Contract EPA-68-02-1982)
(PB-270778/4; EPA-450/3-77-012) Avail: NTIS HC A08/MF A01 CSCL 13B

A technical description, user's guide and program listing are provided for (1) STRAM - a variable trajectory, reactive plume-segment model for ground level air pollution assessments resulting from multi-source emissions on a multi-state scale, and (2) a supporting program, Random-to-Grid, which generates gridded wind data for STRAM from synoptic wind data at arbitrarily located observing stations. The reactive plume chemistry is calculated by a Subroutine STRAC and related subroutines, which calculate the diffusion, the wet and dry depletion, and the reactive chemistry within each plume segment. GRA

N78-13654# Brigham Young Univ., Provo, Utah.
THE HUD 701 LAND USE ELEMENT. IMPLEMENTATION IN THE PUBLIC LAND STATES
Doyle W. Buckwalter, Rick D. Burtenshaw (Utah State Dept. of Community Affairs), and Douglas R. Dickenson (Utah State Dept. of Community Affairs) Dec. 1976 114 p refs Sponsored by HUD
(PB-270752/9) Avail: NTIS HC A06/MF A01 CSCL 13B

Land use for residential, commercial, industrial, and other activities is discussed. In addition to the numerous documents discussing land use proposals, the study emphasizes the data obtained through questionnaires and interviews from pertinent federal and state officials in the intermountain region. GRA

N78-13655# Environmental Protection Agency, Ann Arbor, Mich. Standards Development and Support Branch.
A STUDY OF METHODS FOR REDUCING EVAPORATIVE BACKGROUND HYDROCARBON EMISSIONS FROM NEW VEHICLES
Thomas Rarick and Lou Donato Oct. 1976 19 p refs
(PB-270691/9; EVAP-76-4) Avail: NTIS HC A02/MF A01 CSCL 13B

Tests were conducted on 4 test vehicles for which total emissions were measured intermittently over a 3-week period. Between emission measurements certain vehicles were baked and/or driven on a dynamometer to attempt to reduce their background emissions. At the end of this testing at least two repeat background emissions tests were conducted on each vehicle. The results are discussed. GRA

N78-13656# Transportation Systems Center, Cambridge, Mass.
HIGHWAY AIR POLLUTION DISPERSION MODELING: PRELIMINARY EVALUATION OF THIRTEEN MODELS Final Report, Jun. 1973 - Aug. 1974
Eugene M. Darling, Jr., David S. Prerau, Paul J. Downey, and Peter H. Mengert Jun. 1977 255 p refs
(PB-271049/9; DOT-TSC-OST-77-33) Avail: NTIS HC A12/MF A01 CSCL 13B

A data base management system specifically designed for evaluating dispersion models, was used in the testing process. Because of inadequacies in the Airedale data, it proved necessary to employ, synthetic data sample for use in determining how closely the model predictions agree with one another. Five models (three Gaussian and two Conservation of Mass) emerged as Consensus Models. However, the limited range of the data elements in this sample causes this finding to be preliminary. Further experiments with synthetic data are planned to extend the range of applicability of these initial results, pending the availability of highway air quality data suitable for model validation. GRA

N78-13657# Environmental Protection Agency, Seattle, Wash.
THE ALASKAN OIL DISPOSITION STUDY: POTENTIAL AIR QUALITY IMPACT OF A MAJOR OFF-LOADING TERMINAL IN THE PACIFIC NORTHWEST
David C. Bray Mar. 1977 123 p refs
(PB-271261/0; EPA-910/9-77-044) Avail: NTIS HC A06/MF A01 CSCL 13B

The air quality impact of a marine oil transfer terminal for Alaskan oil is evaluated. An evaluation of specified sites with regard to present emissions and air quality; the determination of the potential emissions associated with a major crude oil offloading facility; and a preliminary modeling analysis to assess the potential air quality problems which might be associated with the operation of such a port are included. GRA

N78-13658# Environmental Protection Agency, Atlanta, Ga. Air and Hazardous Materials Div.
ENVIRONMENTAL NOISE ASSESSMENT, MOUNTAIN VIEW, GEORGIA Final Report
Kent C. Williams Jul. 1977 233 p refs
(PB-271537/3; EPA-904/9-77-021) Avail: NTIS HC A11/MF A01 CSCL 06F

Information is provided regarding the environmental noise levels at sixteen locations in the City of Mountain View, Georgia, adjacent to Hartsfield International Airport in Atlanta. Continuous twenty-four hour monitoring of environmental noise levels was conducted at the selected sites for periods of time ranging from two days to three weeks. For each of the locations examined, the minimum information obtained on an hourly basis was-the hourly equivalent A-weighted sound level Leq(1), the maximum A-weighted sound level for the period, L50, the A-weighted sound level exceeded 50 percent of the time, and L90, the A-weighted sound level exceeded 90 percent of the time. Results of the data analysis showed average day-night sound levels, Ldn, higher than 85 dbA at two locations. In addition, the measured Ldn exceeded 80 dbA on several occasions at four additional sites. Typically, Ldn exceeded 75 dbA at all other locations over a measuring area of approximately 1.5 square miles. GRA

N78-13659# Air Pollution Technology, Inc., San Diego, Calif.
VENTURI SCRUBBER PERFORMANCE MODEL Final Report, 1 Mar. - 30 May 1976
Shui-Chow Yung, Seymour Calvert, and Harry F. Barbarika Aug. 1977 215 p refs
(Contract EPA-ROAP-21ADL-002)
(PB-271515/9; EPA-600/2-77-172) Avail: NTIS HC A10/MF A01 CSCL 07A

Venturi scrubber design equations are reviewed and evaluated. Calvert's differential equation for particle collection and Boll's differential equation for pressure drop were selected for numerical solution, and the results are presented graphically. Particle collection and pressure drop of venturi scrubbers can be approximated by the collection occurring in the venturi throat and by the drop acceleration loss, respectively. Simplified equations were derived by applying Calvert's and Boll's equations to the venturi throat section. The new design equations are much simpler to use, and they compare favorably with available performance data. GRA

N78-13660# Midwest Research Inst., Kansas City, Mo.
STANDARDIZATION OF STATIONARY SOURCE METHOD FOR VINYL CHLORIDE Final Report
George W. Scheil May 1977 52 p
(Contract EPA-68-02-1098)
(PB-271513/4; EPA-600/4-77-026) Avail: NTIS HC A04/MF A01 CSCL 07D

Vinyl chloride samples in Tedlar bags remain stable for more than one week. Aluminized Mylar bags can also be used if the samples are analyzed within two days. Several compounds can interfere with the gas chromatographic analysis by forming a single unresolved peak with vinyl chloride. Retention indices have been measured for several compounds on three useful GC columns. Nearly all samples were satisfactorily resolved with the proper choice of column. Pressurized gas cylinders of vinyl chloride in nitrogen were used for calibrations. GRA

N78-13661# Battelle Columbus Labs., Ohio.
METHOD FOR ANALYZING EMISSIONS FROM ATMOSPHERIC FLUIDIZED-BED COMBUSTOR Final Report, Sep. 1976 - Mar. 1977.
E. L. Merryman, A. Levy, G. W. Felton, K. I. Liu, and J. M. Allen Apr. 1977 102 p refs
(Contract EPA-68-02-1409)
(PB-271514/2; EPA-600/7-77-034) Avail: NTIS HC A06/MF A01 CSCL 07D

An experimentally developed method to comprehensively sample and analyze an atmospheric-pressure fluidized-bed combustion (FBC) unit is described. The method is aimed at providing a cost and information effective environmental assessment of FBC units. A general discussion of the pertinent areas likely to be encountered in sampling and analyzing specimens from FBC units; for example, streams encountered in FBC units, the selection of streams, procedures for sampling gaseous, solid, and liquid streams, and the multilevel analytical approach to emission characterization defined by EPA for combustion units, is included. GRA

N78-13662# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON ENVIRONMENTAL QUALITY, NO. 154
29 Nov. 1977 67 p Transl. into ENGLISH from Selected Foreign Periodicals (Brazil)
(JPRS-70241) Avail: NTIS HC A04/MF A01

Translations are presented from the world press of articles and press commentaries on environmental pollution and its effects and pollution control technology, organization, and programs. Author

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N78-13663 California Univ., Santa Cruz.
MESOZOIC GEOLOGY OF THE KODIAK ISLANDS AND ITS BEARING ON THE TECTONICS OF SOUTHERN ALASKA Ph.D. Thesis
William Ronald Connelly 1976 234 p
Avail: Univ. Microfilms Order No. 77-16880

The Kodiak Islands, composed of a series of northeast trending belts of highly deformed schists, were geologically examined. Schist terrains were studied in regard to their Jurassic K-Ar ages, and volcanic origins. The tectonics of the Islands were theorized according to these studies. Dissert. Abstr.

N78-13664 Tulsa Univ., Okla.
THE DESIGN OF DISCRETE NONADAPTIVE OPERATORS FOR SEISMIC DATA PROCESSING Ph.D. Thesis
Kenneth L. Peacock 1977 132 p
Avail: Univ. Microfilms Order No. 77-17258

The mathematical formulation of certain discrete operators useful for the filtering of seismic data is presented. The operators are of the nonadaptive type and are constructed by the inverse Fourier transform. Formulas and graphs to aid in operator length selection are given based on envelope decay of the operators. This approach in conjunction with the ideal highcut filter design results in a flexible approach to bandpass filtering where operators can be constructed based on their final response rather than initial response. Dissert. Abstr.

N78-13665 Alaska Univ., College.
PULSATING AURORA: LOCAL AND GLOBAL MORPHOLOGY Ph.D. Thesis
Ola Royrvik 1976 209 p
Avail: Univ. Microfilms Order No. 77-15144

Low intensity auroras that undergo rapid alternating increases and decreases of luminosity are described. Extensive data, available from groundbased low-light-level television cameras and satellite scanners, allowed a detailed study of these pulsating auroras. Intensity variations were found to be either repetitive, quasiperiodic or occasionally periodic with a time scale ranging from a second to several tens of seconds. Pulsations occurred in auroral arcs, arc segments and patches of fixed or variable areas during the lifetime of a single pulsation. Temporal and spatial characteristics were found to be highly variable over a broad and continuous spectrum; rapid changes from one set of characteristics to another frequently occurred as did reversible changes from pulsating to nonpulsating auroras. Dissert. Abstr.

N78-13666 Boston Coll., Chestnut Hill, Mass.
AURORAL STUDIES WITH DMSP IMAGES Ph.D. Thesis
Robert Emerson Sheehan 1977 221 p
Avail: Univ. Microfilms Order No. 77-17607

Auroral images from U.S. Air Force DSMP weather satellites were examined. These satellites scan television-like images in the near infrared region from a circular orbit at 815 to 850 km altitude in the dawn-dusk or noon-midnight local time plane. Each image examined was rated according to a qualitative auroral activity scheme. The period of 14 November through 16 December 1972 was studied in detail for auroral boundary determinations and comparisons with groundbased magnetometer data. Dissert. Abstr.

N78-13667 Florida Univ., Gainesville.
MODULATION OF WIND GENERATED WAVES BY LONG GRAVITY WAVES Ph.D. Thesis
Allan M. Reece, Jr. 1976 209 p
Avail: Univ. Microfilms Order No. 77-17048

Cyclic short wave variations that occur during active generation of the short wave field by wind were investigated. Measurements consisting of wave slope time series were made in laboratory environments allowing the independent generation of two scales of motion. Wave slope was measured locally, and continuously in time with a device utilizing the phenomenon of optical refraction at the air sea interface as the basis for the detection of slope angle. It was found that within the experimental bounds short wave slope energy exhibits a cyclic variation along the long wave profile that is related to that profile and characterized as a modulation. Dissert. Abstr.

N78-13668 British Library Lending Div., Boston Spa (England).
THE DISTRIBUTION OF ULTRA-VIOLET RADIATION OVER THE GLOBE
V. A. Belinskiy and L. M. Andriyenko [1977] 10 p refs Transl. into ENGLISH from Ukr. Nauch.-Issled. Gidromet. Inst., Radiat. Process. Atmos. Earth's Surf. (Kiev), 1974 p 277-281 In ENGLISH and RUSSIAN
(BLL-M-24911-(5828.4F); BLL-Trans-1295-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Charts of the distribution of monthly and annual sums of global ultraviolet radiation were compiled using a simplified radiation model of the atmosphere and considering cloud cover. Mean monthly coefficients of the Angstrom turbidity coefficient and mean monthly ozone amounts were used. Characteristics of atmospheric transparency were utilized, taking into account the season, the underlying surface, circulation and precipitation. Results are shown in tabular form. Author

N78-13669*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN ANALYSIS OF THE FIRST TWO YEARS OF GASP DATA
J. D. Holdeman, G. D. Nastrom (Control Data Corp., Minneapolis, Minn.), and P. D. Falconer (Albany Univ., N. Y.) 1977 10 p refs Presented at 4th Joint Conf. on Sensing of Environmental Pollutants, New Orleans, La., 6-11 Nov. 1977; sponsored by Am. Chem. Soc.
(NASA-TM-73817; E-9406) Avail: NTIS HC A02/MF A01 CSCL 04A

Distributions of mean ozone levels from the first two years of data from the NASA Global Atmospheric Sampling Program (GASP) show spatial and temporal variations in agreement with previous measurements. The standard deviations of these distributions reflect the large natural variability of ozone levels in the altitude range of the GASP measurements. Monthly mean levels of ozone below the tropopause show an annual cycle with a spring maximum which is believed to result from transport from the stratosphere. Correlations of ozone with independent meteorological parameters, and meteorological parameters obtained by the GASP systems show that this transport occurs primarily through cyclogenesis at mid-latitudes. Author

N78-13670*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GLOBAL SENSING OF GASEOUS AND AEROSOL TRACE SPECIES USING AUTOMATED INSTRUMENTATION ON 747 AIRLINERS
Porter J. Perkins and Leonidas C. Papathakos 1977 11 p refs Presented at 4th Joint Conf. on Sensing of Environmental Pollutants, New Orleans, La., 6-11 Nov. 1977
(NASA-TM-73810; E-9396) Avail: NTIS HC A02/MF A01 CSCL 04A

The Global Atmospheric Sampling Program (GASP) by NASA is collecting and analyzing data on gaseous and aerosol trace species in the upper troposphere and lower stratosphere. Measurements are obtained from automated systems installed on four 747 airliners flying global air routes. Advances were made in airborne sampling instrumentation. Improved instruments and analysis techniques are providing an expanding data base for trace species including ozone, carbon monoxide, water vapor, condensation nuclei and mass concentrations of sulfates and nitrates. Simultaneous measurements of several trace species obtained frequently can be used to uniquely identify the source of the air mass as being typically tropospheric or stratospheric. A quantitative understanding of the tropospheric-stratospheric exchange processes leads to better knowledge of the atmospheric impact of pollution through the development of improved simulation models of the atmosphere. Author

N78-13671*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A COMPARISON OF SATELLITE SYSTEMS FOR GRAVITY FIELD MEASUREMENTS
P. Argentiero and B. Lowrey Nov. 1977 40 p refs Submitted for publication
(NASA-TM-78055; X-932-77-267) Avail: NTIS HC A03/MF A01 CSCL 08N

A detailed and accurate earth gravity field model is important to the understanding of the structure and composition of the earth's crust and upper mantle. Various satellite-based techniques for providing more accurate models of the gravity field are analyzed and compared. A high-low configuration satellite-to-satellite tracking mission is recommended for the determination of both the long wavelength and short wavelength portions of the field. Satellite altimetry and satellite gradiometry missions are recommended for determination of the short wavelength portion of the field. Author

N78-13672*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OCEAN GRAVITY AND GEOID DETERMINATION
W. D. Kahn, J. W. Siry, R. D. Brown (Computer Scie. Corp., Silver Spring, Md.), and W. T. Wells (EG and G/Washington Anal. Serv., Inc., Riverdale, Md.) Oct. 1977 25 p refs Submitted for publication
(NASA-TM-78054; X-921-77-259) Avail: NTIS HC A02/MF A01 CSCL 08N

Gravity anomalies have been recovered in the North Atlantic and the Indian Ocean regions. Comparisons of 63 2 deg x 2 deg mean free air gravity anomalies recovered in the North Atlantic area and 24 5 deg x 5 deg mean free air gravity anomalies in the Indian Ocean area with surface gravimetric measurements have shown agreement to + or - 8 mgals for both solutions. Geoids derived from the altimeter solutions are consistent with altimetric sea surface height data to within the precision of the data, about + or - 2 meters. Author

N78-13673# Lockheed Missiles and Space Co., Palo Alto, Calif.
DIFFUSION AURORAL ZONE. 1: MODEL OF THE EQUATORIAL BOUNDARY OF THE DIFFUSION AURORAL ELECTRON INTRUSION ZONE IN THE EVENING AND NEAR-MIDNIGHT SECTORS
Iu. I. Galperin, J. Crasnier, Iu. V. Lisakov, L. M. Nikolaenko, V. M. Sinitsyn, J. A. Sauvaud, and V. L. Khalipov 1977 18 p refs Transl. into ENGLISH from Kosm. Elektr. (USSR), v. 15, no. 3, 1977 p 421-434
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The equatorial diffusion zone boundary (DZB) of soft electron intrusion wil 0.01 - 0.1 erg/square cm sec.sr in the evening and near-midnight quadrant of local geomagnetic time is localized according to measurements on the Oreol-1 and Oreol-2 satellites executed within the framework of the Soviet-French experiments Arkad-1 and Arkad-2. It is shown that this boundary, observed at ionosphere altitudes, is a projection of the inner boundary of the plasma layer which practically agrees with the plasmopause under longitudinal perturbation conditions. Arguments are presented favoring identification of the DZB under these conditions with the projection of a domain with cold plasma concentration on the equatorial plane within the limits 10 less than or equal to cold plasma concentration, which in turn is less than or equal to 0.008 cu cm. Author

N78-13674# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
PLASMA WAVES IN THE POLAR CUSP: OBSERVATIONS FROM HAWKEYE 1 Progress Report
D. A. Gurnett and L. A. Frank Jul. 1977 71 p refs
(Contract N00014-76-C-0016; NAS1-11257)
(AD-A045321; U-of-Iowa-77-21) Avail: NTIS HC A04/MF A01 CSCL 20/9

In this paper we investigate the characteristics of plasma waves observed by the Hawkeye 1 spacecraft in the vicinity of the polar cusp. The primary types of plasma waves associated with the polar cusp are (1) a band of ULF-ELF magnetic noise extending from a few Hz to several hundred Hz, (2) a broad-band electrostatic emission extending from a few Hz to about 30 to 100 kHz, with maximum intensities at about 10 to 50 Hz, (3) electrostatic electron cyclotron waves near the electron gyrofrequency and (4) whistler-mode auroral hiss emissions. Of these various types of waves, only the ULF-ELF magnetic noise is uniquely associated with the cusp in the sense that the noise can be used as a reliable indicator of the polar cusp region. All of the other types of plasma waves occur in regions adjacent to the polar cusp as well as in the cusp itself. GRA

N78-13675# Naval Research Lab., Washington, D. C.
RECENT RESULTS ON CLEAVAGE, BIFURCATION AND CASCADE MECHANISMS IN IONOSPHERIC PLASMA CLOUDS
S. L. Ossakow, S. T. Zalesak, and N. J. Zabusky Aug. 1977 39 p refs
(AD-A045235; NRL-MR-3579) Avail: NTIS HC A03/MF A01 CSCL 20/9

Cleavage, bifurcation, and cascade mechanisms are investigated in the evolution of striating ionospheric plasma clouds which are subject to the gradient drift instability. The numerical simulations are based on a one-level, two-dimensional model. An initially one dimensional Gaussian-like cloud with a smooth perturbation cleaves and spontaneously develops nonlinear bifurcations of the original perturbation thus forming secondary perturbations (striations). This represents a cascade from longer to shorter wavelength structures. An initially presteepened two dimensional cloud without initial perturbation cleaves and bifurcates to form a protuberance in the cleavage trough. These results demonstrate that cleavage is an inherent process in the evolution of striated ionospheric plasma clouds and plays an important role in the characterization of the late-time nuclear striation power spectrum. Author (GRA)

N78-13676# Analysis and Computer Systems, Inc., Burlington, Mass.
ANALYTICAL AND PROCESSING SYSTEMS FOR ROCKETS AND BALLOON PROBE DATA Final Report, 1 Apr. 1976 - 31 Mar. 1977
Harold L. Dolan, III, Ching-Lan Lin, and Chung-Jen Tsai Apr. 1977 56 p
(Contract F19628-74-C-0169)
(AD-A045280; AFGL-TR-77-0101) Avail: NTIS HC A04/MF A01 CSCL 04/1

This report describes a number of numerical and processing procedures that were developed to aid Air Force Geophysics Laboratory (AFGL) researchers in the analysis and interpretation of experimental data. The research areas for which these techniques were developed include: The determination of the number densities of atmospheric constituents by the technique of absorption spectroscopy, balloon-borne nephelometer measurements of atmospheric aerosol properties, and the study of induced atmospheric optical emissions by rocket-borne electron accelerators. GRA

N78-13677# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
UPPER ATMOSPHERE CHEMICAL RELEASE AND SMOKE TRAIL TRIANGULATION Final Report, Sep. 1974 - Aug. 1977
Robert G. Roper and Howard D. Edwards Aug. 1977 8 p
(Contract F19628-74-C-0085; AF Proj. 7635)
(AD-A045019; GIT-AER-E-16-648; AFGL-TR-77-0161) Avail: NTIS HC A02/MF A01 CSCL 04/1

This report reviews the four field trips undertaken and the three scientific reports published during the term of this contract. Author (GRA)

N78-13678# Keo Consultants, Newton, Mass.
IMAGING ALL-SKY PHOTOMETER SYSTEM Final Report, 4 Mar. 1976 - 30 Jun. 1977
Robert H. Eather 30 Jun. 1977 37 p refs
(Contract F19628-76-C-0168)
(AD-A045020; KEO-07; AFGL-TR-77-0155) Avail: NTIS HC A03/MF A01 CSCL 04/1

This report describes the design, fabrication, and demonstration of an all-sky photometric imaging system for narrow-bandwidth auroral and airglow measurements. Testing and use on board the AF NKC 135 research aircraft is described. Reduction and analysis of data obtained on three research expeditions are summarized, and scientific results presented. Author (GRA)

N78-13679# Avco-Everett Research Lab., Everett, Mass.
INFRARED RADIATION IN A REAL TROPICAL ATMOSPHERE Final Technical Report, 1 Nov. 1975 - 30 Apr. 1977
Lee A. Young Griffiss AFB, N. Y. RADC Aug. 1977 96 p refs
(Contract F04701-75-C-0047; ARPA Order 2837)
(AD-A045408; RADC-TR-77-288) Avail: NTIS HC A05/MF A01 CSCL 04/1

Transmission of infrared radiation in the 8-13 and 16.5-21 micrometers spectral regions from 3 km altitude through the atmosphere to outer space has been evaluated. Analysis of tropical radiosonde atmospheric profiles of temperature and humidity shows that fluctuations in the total amount of water vapor above 3 km cause the transmission to vary by amounts from 10% to two orders of magnitude. Fluctuations in the effective temperature or pressure for absorption are shown to be small. The Curtis-Godson approximation is analyzed in detail for this problem. Also, effective parameters describing an atmospheric slant path are formulated for absorption by the water vapor continuum. The total amount of water vapor above 3 km varies chiefly as the trade wind inversion rises above or falls below that altitude; it correlates poorly with the absolute humidity at 3 km. The atmospheric transmission can be obtained in real time from measurements of atmospheric emission. Fluctuations in the effective emission temperature, calculated from radiosonde data, are relatively small. However, further study of the effect of cirrus clouds on the transmission-emission relationship would be desirable. Author (GRA)

N78-13680# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
AERONOMY OF THE STRATOSPHERE AND MESOSPHERE Final Report, 15 Sep. 1974 - 14 Sep. 1977
Leslie C. Hale Jul. 1977 15 p refs
(Grant DAHC04-75-G-0031)
(AD-A045795; PSU-IRL-FR-77-2; ARO-12589.2-GS) Avail: NTIS HC A02/MF A01 CSCL 04/1

Previous research results summarized in Ice Particulates in the Mesosphere, by E. T. Chasworth and L. C. Hale, published in Geophysical Research Letters, 1-8 Dec 74, led to the conclusion that the mesosphere contains a high density of very small particulates which normally dominate ionization loss processes. This idea has now been extended to encompass the transport of particulate and their role in coupling processes between the upper and lower atmosphere. This report consists of a resume of the research performed, a manuscript of a paper summarizing important scientific findings, a list of publications and a list of scientific personnel. Author (GRA)

N78-13681# Naval Weapons Center, China Lake, Calif.
COSO GEOTHERMAL CORROSION STUDIES Final Report
Stephen A. Finnegan Oct. 1977 92 p refs
(AD-A045511; NWC-TP-5974) Avail: NTIS HC A05/MF A01 CSCL 11/6

This report documents the results of geothermal corrosion studies conducted at the Coso Thermal Area, Naval Weapons Center, China Lake, California. Nine different common construction-grade piping materials were tested for periods up to about one year in three distinctive low-pressure, medium temperature environments (acid-sulfate steam, groundwater-diluted steam, and hot mineralized alkaline water) under anaerobic and aerobic conditions. Exposed specimens were analyzed principally by optical microscopy and X-ray diffraction techniques, and selectively by scanning electron microscopy, X-ray fluorescence, and atomic absorption spectroscopy. Corrosion/erosion modes, rates, and principal insoluble corrosion products were established and mechanisms based on established theory proposed to account for the modes of deterioration. Corrosion results were compared for the three fluid systems, and specific materials were then recommended for use in each of the fluid types found at the Coso Thermal Area. Author (GRA)

N78-13682# General Sensors, Inc., Fort Washington, Pa.
ANALYTICAL STUDY OF PASSIVE TECHNIQUES FOR MEASURING ATMOSPHERIC PARAMETERS Final Report, 17 Nov. 1976 - 6 Sep. 1977
Harry Sadjian 6 Jan. 1977 86 p refs
(Contract N62269-77-C-0058)
(AD-A045717; GS-1-77-NADC) Avail: NTIS HC A05/MF A01 CSCL 20/14

Calculations are presented that show the degree of recovery of both atmospheric water-vapor and temperature distributions using passive infrared and microwave radiometry-assuming

ground-based radiometers. A gradient technique is used to recover a temperature profile with 2 inversions and a water-vapor profile with 5 inversions. The method is applicable to distributions to 2 Km. Calculations are also presented that show the affect of water-vapor and temperature on radio wave propagation and the affect of visibility on the passive methods. Author (GRA)

N78-13683# Army Engineer Waterways Experiment Station, Vicksburg, Miss.

STUDY TOUR, ENGLAND, FRANCE, RUSSIA, AND JAPAN, CENTRIFUGE INSTALLATIONS AND MODELING TECHNIQUES IN STRUCTURE FOUNDATION DESIGN, 13 JUNE - 13 JULY 1977

1977 40 p

(AD-A045764) Avail: NTIS HC A03/MF A01 CSCL 13/2

The primary objective of this study was to become familiar with centrifuge installations and modeling techniques employed in the design of foundations for structures under static and dynamic loading. In addition, attention was to be directed toward construction methods in seismic areas and the evaluation of various techniques that have been employed in this regard. To be added to these objectives is the information to be gained from the exposure to new (if not different) engineering methods, needs, and procedures. It is believed that all the objectives were amply satisfied, and the study could be characterized as an unqualified success. GRA

N78-13684# Air Force Geophysics Lab., Hanscom AFB, Mass.

LWIR (7-24-MICROMETER) MEASUREMENTS FROM THE LAUNCH OF A ROCKET BORNE SPECTROMETER INTO A QUIET ATMOSPHERE (1974)

James W. Rogers 24 May 1977 117 p refs

(AD-A045466; AFGL-TR-77-0113; AFGL-ERP-597; DNA-HAES-64) Avail: NTIS HC A06/MF A01 CSCL 17/5

A liquid-helium-cooled, long-wavelength infrared (LWIR) spectrometer was successfully launched on 14 Feb. 1974 from the University of Poker Flat Research Range at Chatanika, Alaska, part of the DNA ICECAP 74 Program. The Spectrometer, which employs a circular-variable filter, was almost identical to one flown on 22 Mar 1973 that provided the first measurements of the altitude profile of the infrared spectrum of the upper-atmospheric emissions between 7 and 24 micrometers. The 1973 measurements were from an energetically pumped atmosphere during the occurrence of an IBC II aurora. The objective of the 1974 flight was to obtain emission data from an aurorally quiet atmosphere to determine the contribution of the auroral energy input to the data obtained in 1973. The payload was successfully launched during nonauroral conditions, and data were obtained on the 15 micrometer carbon dioxide (nu 2) emission from 74 to 160 km and on the 9.6 micrometer ozone (nu 3) emission between 74 and 110 km. Above 110 km, significant unidentified emission was again observed at 9.3 micrometers. GRA

N78-13685# Avco-Everett Research Lab., Everett, Mass.

IR ATMOSPHERIC MEASUREMENTS Interim Report, 30 Jun. 1975 - 28 Feb. 1976

H. P. Kent and P. F. Kellen Jun. 1977 31 p refs

(Contracts F30602-75-C-0235; ARPA Order 2646)

(AD-A045546; RADC-TR-77-202) Avail: NTIS HC A03/MF A01 CSCL 17/5

Atmospheric radiance data obtained enpassant during LWIR observations of satellites may be used to produce a near real-time extinction model for the 20 micrometers transmission window. Work is described and some interim results are presented on an experiment intended to characterize atmospheric absorption scaling with wavelength. Measuring precision of background limited radiometers is improved by long period signal averaging. A facility for accomplishing this is described. Radiant intensity measurements of asteroids and deep space satellites are presented. Author (GRA)

N78-13686# California Univ., Livermore. Lawrence Livermore Lab.

INSTALLATION OF HORIZONTAL SEISMOMETERS IN THE LLL SEISMIC NET AND THEIR CALIBRATION

Marvin D. Denny 25 Jan. 1977 83 p ref

(Contract W-7405-eng-48)

(UCRL-52216) Avail: NTIS HC A05/MF A01

The Lawrence Livermore Laboratory seismic net was upgraded by installing two horizontal seismometers at each of the four LLL stations. These seismometers record radial and transverse ground motion from underground nuclear explosions at the Nevada Test Site and complement the vertical components which were installed several years ago. Each station now monitors three orthogonal components of ground velocity over a broad frequency band. ERA

N78-13687# Los Alamos Scientific Lab., N. Mex.

INVESTIGATION OF CREEP INSTABILITY AS A MECHANISM FOR GLACIER SURGES

W. S. B. Paterson (Dept. of Energy, Mines and Resources, Ottawa, Ontario), U. Nitsan, and G. K. C. Clarke (Brit. Columbia Univ., Vancouver) 1976 36 p refs Presented at Intern. Workshop on the Dyn. of Glacier Variations and Surges, Alma Ata, USSR, Sep. 1976

(Contract W-7405-eng-36)

(LA-UR-77-550; Conf-7609127-1) Avail: NTIS HC A03/MF A01

Creep instability was investigated by considering a simple slab model which includes the effect of ice advection normal to the surface. Whether a steady-state solution of the heat transfer equation exists depends on the value of a stability parameter proportional to the ratio of the rate of deformational heat production to the rate at which this heat is conducted away. If the parameter exceeds a certain critical value, instability occurs and basal ice eventually reaches melting point. The ice mass can then start to slide over its bed. If the stability parameter exceeds a second higher critical value, a layer of basal ice at melting point will form. The critical values depend on geothermal heat flux and strongly on advection. Upward advection as in the ablation area, decreases stability whereas downward advection (accumulation) increases it. On the other hand, if unstable conditions exist, accumulation increases the growth rate of the instability while ablation decreases it. Calculations suggest that certain natural ice masses may be unstable. The time for the instability to develop, however, is of the order of 100 to 10,000 yr., whereas the residence time of the ice in many glaciers is less than 10,000 yr. ERA

N78-13688# Sandia Labs., Albuquerque, N. Mex. Geomechanics Research Div.

COMPRESSION WAVE STUDIES IN SOLENHOFEN LIMESTONE

K. W. Schuler and D. E. Grady May 1977 56 p refs

(Contract EY-76-C-04-0789)

(SAND-76-0279) Avail: NTIS HC A04/MF A01

Dynamic compression wave studies were conducted on Solenhofen limestone in the stress range of 0 to 3.0 GPa. Plate impact techniques were used to provide a transient stress input and diffuse reflector laser interferometry was used to study the evolution of these pulses through various thicknesses of limestone. Both the loading and unloading stress-strain response was determined from the measured particle velocity profiles. A dynamic yield stress of 0.67 plus or minus .05 GPa was observed which is consistent with static failure envelope data. However, there is a marked difference between the dynamic and hydrostatic stress-strain curves at stress levels where the calcite I yields II yields III phase transitions occur. It appears that the phase transitions which occur during shock wave loading do not take the material fully into the high pressure phase but instead reach a metastable mixed phase condition. ERA

N78-13689# National Physical Lab., Teddington (England). Div. of Quantum Metrology.

A PRELIMINARY INVESTIGATION OF THE ATMOSPHERIC SPECTRUM IN THE 820-940/cm REGION. SENSITIVITY OF LIMS CHANNEL 4 (HNO3) TO RADIATION FROM FLUOROCARBONS 11 AND 12

J. E. Harries, M. J. Bangham, and N. D. Goldenfeld Jul. 1977 19 p refs

(NPL-QU-37) Avail: NTIS HC A02/MF A01

The spectral contamination of the 131.3 micrometer acid channel to be used in the limb infrared monitor of the stratosphere (LIMS) experiment on the Nimbus G spacecraft, due to adjacent (10.8 and 11.3 micrometer) bands of fluorocarbons 11 and 12 was investigated. Spectral band model calculations were carried

out which indicate that significant contamination can occur at altitudes below about 25 km. Author (ESA)

N78-13690# California Inst. of Tech., Pasadena. Earthquake Engineering Research Lab.
THE EARTHQUAKE RESPONSE OF DETERIORATING SYSTEMS Ph.D. Thesis
Nathan Craig Gates Mar. 1977 144 p refs
(Grants NSF ENV-74-19135; NSF ATA-74-19135)
(PB-271090/3; EERL-77-03) Avail: NTIS HC A07/MF A01 CSCL 13B

A numerical investigation of the response of these six systems is performed using an ensemble of twelve earthquakes. The numerical results are presented as response spectra corresponding to six different ductilities. An approximate analytical method for calculating the earthquake response of deteriorating systems from a linear response spectrum is presented. The analytical method is compared to existing methods. A comparison with the numerical results is also made. Based upon these comparisons, it is concluded that the new method represents a significant improvement over currently available methods for predicting the earthquake response of deteriorating and nondeteriorating systems. GRA

N78-13691# California Inst. of Tech., Pasadena. Earthquake Engineering Research Lab.
STUDIES ON THE EFFECT OF DIFFERENTIAL MOTIONS OF TWO FOUNDATIONS UPON THE RESPONSE OF THE SUPERSTRUCTURE OF A BRIDGE
Ahmed M. Abdel-Ghaffar Jan. 1977 96 p refs Sponsored in part by Geological Survey
(Grant NSF ENV-74-19135)
(PB-271095/2; EERL-77-02) Avail: NTIS HC A05/MF A01 CSCL 13B

The dynamic response of a long beam model of a bridge to both steady-state and random excitations applied at the supports was studied. The harmonic and random end-excitations were analyzed in the frequency and time domains, respectively. A method to analyze the dynamic soil-bridge interaction of a simple two-dimensional bridge model erected on an elastic half-space, with the input excitation in the form of incident plane SH-waves is also included. The bridge model consists of an elastic shear girder supported by two rigid abutments and rigid foundations which have a circular cross section and which are welded to the half-space. Finally, the dynamic response of the bridge and the effect of the radiative damping in the half-space on the interaction of the bridge are also studied. GRA

N78-13692# California Univ., Berkeley. Earthquake Engineering Research Center.
DRAIN-TABS: A COMPUTER PROGRAM FOR INELASTIC EARTHQUAKE RESPONSE OF THREE-DIMENSIONAL BUILDINGS
Rafael Guendelman-Israel (Chile Univ.) and Graham H. Powell Mar. 1977 147 p refs Sponsored in part by Ford Found.
(Grant NSF ENV-76-04262)
(PB-270693/5; UCB/EERC-77/08) Avail: NTIS HC A07/MF A01 CSCL 13M

A computational procedure and computer program for the inelastic dynamic response analysis of three-dimensional buildings of essentially arbitrary configuration are described. The building is idealized as a series of independent plane substructures interconnected by horizontal rigid diaphragms. Each substructure can be of arbitrary geometry and include structural elements of a variety of types. It is not necessary for all substructures to connect to all diaphragms, so that structures with independent diaphragms of some levels can be idealized (as, for example, two towers connected only at the top floors). The analysis makes use of substructuring techniques to improve computational efficiency. GRA

N78-13693# National Center for Atmospheric Research, Boulder, Colo. Atmospheric Analysis and Prediction Div.
THE DELTA-EDDINGTON APPROXIMATION FOR A VERTICALLY INHOMOGENEOUS ATMOSPHERE
W. T. Wiscombe Jul. 1977 73 p refs
(Grant NSF ATM-72-10157)
(PB-270618/2; NCAR-TN-121/STR) Avail: NTIS HC A04/MF A01 CSCL 04A

The delta-Eddington approximation of Joseph, Wiscombe, and Weinman (1976) is extended to an atmosphere divided up by internal levels into homogeneous layers. Flux continuity is enforced at each level, leading, as the mathematical essence of the problem, to a penta-diagonal system of linear equations for certain unknown constants. Fluxes (up, direct down, diffuse down, and net) are then predicted at each level. Unphysical results of the model are examined in detail. Potential numerical instabilities in the solution are noted and corrected, and an extremely fast, well-documented computer code resulting from this analysis is described and listed. Actual computed fluxes are given for several test problems. GRA

N78-13694# Massachusetts Univ., Amherst. Astronomy Research Facility.
STUDY OF WATER VAPOR LINES IN THE INTERMEDIATE INFRARED REGION Final Report, Jun. 1975 - May 1976
John Strong and Peter Hansen Dec. 1976 59 p refs
(Grant NOAA-04-5-158-61)
(PB-272203/1; UMASS-ARF-76-302; NOAA-77072901) Avail: NTIS HC A04/MF A01 CSCL 07D

The determination of accurate absorption coefficients for water vapor is presented. Four partial pressures of water vapor are each combined with background pressures of one-third, two-thirds, and one atmosphere of dry air, and the resultant transmission is recorded. The data were acquired using a large absorption cell 30 meters long and 1 meter in diameter. The cell is used in a six-pass mode to obtain an equivalent optical path of 180 meters. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N78-13695 North Carolina Univ., Chapel Hill.
PRECIPITATION EFFICIENCY IN THE CONTERMINOUS UNITED STATES EAST OF THE ROCKY MOUNTAINS Ph.D. Thesis
Jeffrey Thomas Lutz 1976 184 p
Avail: Univ. Microfilms Order No. 77-17343

Precipitation efficiency (PE), the percentage of the average atmospheric water vapor above a station that is released and falls to earth as measurable precipitation in a given time period was used to describe the efficiency of atmospheric mechanisms in releasing moisture. Research focused on a variety of dynamic precipitation mechanisms, ranging in scale from a small convective storm to an extra tropical hurricane. The highest PE values were associated with frontal uplift and the movement of the center of a disturbance over a station. Terrain influences were found to enhance the precipitation process and therefore contribute to higher PE values. It was determined that efficiencies decrease with increasing distance from major storm activity and that local convective activity can contribute to PE patterns not sufficiently explained by cyclonic and/or frontal mechanisms. Dissert. Abstr.

N78-13696 British Library Lending Div., Boston Spa (England).
THE ROLE OF VARIOUS FACTORS IN THE RADIATIVE HEATING OF STRATUS
N. J. Goysa and V. M. Shoshin [1977] 15 p refs Transl. into ENGLISH from Ukr. Nach.-Issled. Gidromet. Inst. Radiat. Process. Atmos. Earth's Surf. (Kiev), 1974 p 46-51 In ENGLISH and Russian
(BLL-M-24921-(5828.4F); BLL-Trans-1270-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Radiative heating of stratus clouds was studied as an aid to the understanding of cloud evolution. Both shortwave and longwave components of radiative heating were considered at various stages in the development of stratus clouds. Radiative cooling was investigated also, along with temperature variations of different cloud layers. Author

N78-13697 British Library Lending Div., Boston Spa (England).
COMPUTING THE DAILY (MONTHLY) AMOUNTS OF GLOBAL RADIATION ON SLOPES UNDER A CLEAR SKY

D. Sh. Dolidze [1977] 10 p refs Transl. into ENGLISH from Nauchn.-Issled. Gidromet. Inst., Radiat. Process. Atmos. Earth's Surf. (Kiev), 1974 p 196-199 In RUSSIAN and ENGLISH
(BLL-M-24914-(5828.4F); BLL-Trans-1292) Avail: British Library Lending Div., Boston Spa, Engl.

Components of the flux of global radiation on slopes beneath a cloudless sky were computed using Smolyakov's formula as well as Shifrin and Minin's theory. The flux of direct solar radiation was computed using these formulae along with the flux of diffuse radiation. Author

N78-13698 British Library Lending Div., Boston Spa (England).
THE EFFECT OF ATMOSPHERIC TURBIDITY ON THE ACCURACY OF DETERMINING THE CONSTANTS OF ACTINOMETRIC INSTRUMENTS
G. A. Nikolskiy and M. M. Safranova [1977] 13 p refs Transl. into ENGLISH from Nauchn.-Issled. Gidromet. Inst., Radiat. Process. Atmos. Earth's Surf. (KIEV), 1974 p 324-329 In RUSSIAN and ENGLISH
(BLL-M-24939-(5828.4F); BLL-Trans-1298) Avail: British Library Lending Div., Boston Spa, Engl.

Theoretical research on the brightness of the solar aureole and the practice of comparing actinometric instruments with different apertures have shown that there is a definite functional relationship between the ratio of the flux of DSR, as measured by instruments with different apertures and the parameters typifying atmospheric turbidity. Until recently, this parameter has been supplied by the product of the absolute air mass m sub a and Linke's turbidity factor T. Since the angular distribution of the brightness of the aureole is determined by aerosol scattering, and since variation in the concentration of atmospheric water vapor has a marked effect upon the DSR, it is evident that the product m sub a T does not give a fully unique characterization of atmospheric turbidity. Angstrom and Drummond [3, 5] proposed to meet this requirement with the parameter beta = a sub aer (lambda) divided by lambda (-alpha) (where a sub aer is the coefficient of attenuation due to aerosol), as determined from the intensity of DSR in the band 300-700 nm. They obtained a functional relationship between DSR in that band and the absolute mass of the atmosphere, for a range of values of beta. Comparison of the values of beta was determined by using the results of synchronous measurements with the RG-8 and RG-2 filters on the occasion of the pyrheliometer comparisons. Author

N78-13699*# Alabama Univ., Huntsville.
CLOUD PHYSICS LABORATORY PROJECT SCIENCE AND APPLICATIONS WORKING GROUP Final Technical Report
R. J. Hung Nov. 1977 61 p refs
(Contract NAS8-31321)
(NASA-CR-150477; UAH-RR-205) Avail: NTIS HC A04/MF A01 CSCL 04B

The conditions of the expansion chamber under zero gravity environment were simulated. The following three branches of fluid mechanics simulation under low gravity environment were accomplished: (1) oscillation of the water droplet which characterizes the nuclear oscillation in nuclear physics, bubble oscillation of two phase flow in chemical engineering, and water drop oscillation in meteorology; (2) rotation of the droplet which characterizes nuclear fission in nuclear physics, formation of binary stars and rotating stars in astrophysics, and breakup of the water droplet in meteorology; and (3) collision and coalescence of the water droplets which characterizes nuclear fusion in nuclear physics and processes of rain formation in meteorology. Author

N78-13700*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AN ANALYSIS OF MAXIMUM VERTICAL GUSTS RECORDED AT NASA'S 150-METER GROUND WINDS TOWER FACILITY AT KENNEDY SPACE CENTER, FLORIDA
Margaret B. Alexander Sep. 1977 34 p refs
(NASA-TM-78139) Avail: NTIS HC A03/MF A01 CSCL 04B

A statistical summary is presented of vertical wind speed data recorded at NASA's 150-Meter Ground Winds Tower Facility on Merritt Island, Kennedy Space Center, Florida. One year of continuous around-the-clock vertical wind speed measurements processed by the Automatic Data Acquisition System (ADAS) is classified as a function of tower level (10, 18, 60, and 150 meters) and period of reference [day, month, season: winter (October through March) and summer (April through September), and annual]. Intensity, frequency, time of occurrence, prevailing conditions, etc., of the daily maximum vertical gusts (i.e., updraft and downdraft) are determined. The results are compared with the vertical gusts associated with the daily maximum horizontal gust. The intent of this summarization of vertical wind speed data is to provide a general description of wind flow in the lower 150 meters of the atmosphere for the identification of hazards involved in wind shear encounters relative to ascent and descent of the Space Shuttle and conventional aircraft. Author

N78-13701# Naval Air Propulsion Test Center, Trenton, N.J. Propulsion Technology and Project Engineering Dept.
A SURVEY OF ICING CONDITIONS FOR MARINE GAS TURBINES Final Report
K. T. Swan Sep. 1977 71 p refs
(AD-A045558; NAPTC-PE-114) Avail: NTIS HC A04/MF A01 CSCL 21/5

A literature survey was conducted to define the possible hydrometeorological conditions during which icing of the gas turbine inlets of a ship could occur. Also included is a list of all sources of information used during the survey. A frequency-of-occurrence study of the icing conditions found during the literature survey was also done and the results included as maps of the North Atlantic. The North Atlantic was chosen as it gave the most complete data base available at the time. GRA

N78-13702# Naval Postgraduate School, Monterey, Calif.
CHARACTERISTICS OF ATMOSPHERIC FORCING FUNCTIONS M.S. Thesis
Sharon Dill Raney Jun. 1977 53 p refs
(AD-A045177) Avail: NTIS HC A04/MF A01 CSCL 08/3

The hypothesis that both the timing and magnitude of strong and weak atmospheric forcing events can have a significant effect on the seasonal evolution of the upper ocean thermal structure is investigated. Long time series of observations of meteorological data from ocean weather ships P, V, and N in the north Pacific Ocean are used to summarize the characteristics of the atmospheric forcing and the ocean thermal response during the January to August period. The forcing is expressed in terms of u^*3, where u^* is the atmospheric friction velocity, and in terms of the upward heat flux. Although the total input of the three-hourly u^*3 is quite different at all three stations, about 20% of the largest u^*3 values contribute 50% of the accumulated u^*3 and 50% account for 17% of the total at each station. Synoptic forcing events are defined as sustained periods during which the daily mean forcing exceeds the long-term mean. Between 68 and 75% of the total u^*3 occurs during roughly one-third of the time associated with synoptic forcing events defined in terms of u^*3. A significant fraction of the sea-surface temperature increase occurs during periods of low wind speed, rather than periods of excessive insolation. Author (GRA)

N78-13703# Army Missile Research and Development Command, Redstone Arsenal, Ala. Physical Sciences Directorate.
INFRARED AND SUBMILLIMETER EXTINCTION BY FOG
Dorathy Anne Stewart 14 Jul. 1977 55 p
(AD-A045181; DRDMI-TR-77-9) Avail: NTIS HC A04/MF A01 CSCL 04/2

A thorough literature survey of fog drop-size distributions throughout the world is discussed, and data from 36 references are summarized. The review of an extensive list of over 100 references includes additional important information. Ranges of liquid water content and problems of relating this to visibility are examined. Changes in fog characteristics from place to place and from time to time are also considered, and the discussion includes small-scale spatial and temporal fluctuations. GRA

N78-13704# Calspan Corp., Buffalo, N. Y.
THREE-DIMENSIONAL STRUCTURE OF CONVECTIVE STORMS AND THE ROLE OF VERTICAL SHEAR IN STORM LIFE CYCLE Final Report, 1 Apr. 1975 - 30 Sep. 1976
C. William Rogers Sep. 1977 56 p refs
(Contract N00014-75-C-0979)
(AD-A045053; CALSPAN-CK-5976-M-1) Avail: NTIS HC A04/MF A01 CSCL 04/2

A model is presented which describes the three-dimensional location of the updraft in a convective storm as a function of the wind velocity in the low-level inflow to the storm and the storm's motion. This updraft-plane model was used to interpret doppler velocities in RHI scans. The updraft-plane model led to the following hypothesis on the role of vertical shear in the environmental wind in controlling the life cycle of convective storms. If there is an alignment between the horizontal velocity of the middle level air in which the downdraft originates and the orientation and motion of the updraft plane, then the downdraft air, as it sinks through the storm toward the ground, will continually find itself underneath the updraft such that precipitation evaporation and precipitation loading may maintain and strengthen the downdraft. Conversely, if an alignment is not present, then the downdraft may not be maintained and the convective storm may be of the short-lived type. GRA

N78-13705# Naval Research Lab., Washington, D. C.
A STATISTICAL ANALYSIS OF WESTERN PACIFIC TROPICAL CYCLONE FORECAST ERRORS M.S. Thesis
Donald Stevens Nicklin Jun. 1977 52 p refs
(AD-A045133) Avail: NTIS HC A04/MF A01 CSCL 04/2

Western Pacific Tropical cyclone position forecast errors for 10 years (1966-1975) are statistically analyzed. Variations of errors versus a dozen parameters are examined and the trends over the 10 years are discussed. Discriminant analysis techniques were used to isolate categories where forecasts were likely to be above and below the median in East-West and North-South error components. The discriminant analysis was tested on 1976 data and the results are presented. It was confirmed that a small number of readily available parameters, such as location, maximum winds, and speed of movement, can, with reasonable effectiveness, classify a tropical cyclone forecast as representing a group either markedly above or below average errors.
Author (GRA)

N78-13706# Naval Research Lab., Washington, D. C.
DEVELOPMENT OF A BIASING SCHEME TO IMPROVE INITIAL DYNAMICAL MODEL FORECASTS OF TROPICAL CYCLONE MOTION M.S. Thesis
John David Shewchuk Jun. 1977 94 p refs
(AD-A045174) Avail: NTIS HC A05/MF A01 CSCL 04/2

A technique of adjusting the initial steering currents to improve the short-term forecasts of tropical cyclone motion with a dynamical model was tested. Initial tests were performed with hand-analyzed data, although 41 objectively-analyzed cases were also examined to evaluate operational feasibility. Several schemes to track the storm objectively resulted in the use of the streamfunction minimum to define the storm centers. Two biasing approaches were developed. The first used statistical regression equations to predict the initial storm motion, while the second used an empirical relationship to define the initial steering current. Various areal distributions of the bias corrections were then applied to the initial wind fields. Results from these tests indicated improved forecast accuracy if the largest corrections were applied at some distance from the storm center. The biasing decreased average forecast errors for the first 30 hours by about 40% for the hand-analyzed cases and about 30% for the objectively-analyzed cases, with 25% and 15% decreases after 48 hours, respectively. Significant improvements were also observed in the standard deviation of track errors, with averaged decreases of 60% for hand-analyzed cases and 45% for objectively-analyzed cases.
Author (GRA)

N78-13707# Nova Univ., Dania, Fla.
INDEX: AN OCEANOGRAPHIC CONTRIBUTION TO INTERNATIONAL PROGRAMS IN THE MONSOON REGION OF THE INDIAN OCEAN
Dennis Moore 11 Jan. 1977 100 p refs
(Grant NSF IDO-75-01571)
(PB-271272/7; NSF/IDOE-77-132) Avail: NTIS HC A05/MF A01 CSCL 04B

The ocean's complex interactive role with the Indian summer monsoon is studied. The main scientific objective is to understand the time-dependent response of the Indian Ocean to the variable wind forcing due to the monsoons, and the nature of the feedback which the ocean produces on the monsoon regime itself. GRA

N78-13708# National Severe Storms Lab., Norman, Okla.
MESOCYCLONE EVOLUTION AND TORNADO GENERATION WITHIN THE HARRAH, OKLAHOMA STORM
Edward A. Brandes May 1977 40 p refs
(PB-271675/1; NOAA-TM-ERL-NSSL-81; NOAA-77091505)
Avail: NTIS HC A03/MF A01 CSCL 04B

The updraft mesocyclone of a tornado producing thunderstorm was first detected aloft along a convergent and cyclonically sheared boundary between inflow air entering forward and rear storm quadrants. Maximum tangential flow was contained in a jet-like annulus averaging less than 4 km in radius (depending upon the development stage) that lowered to ground prior to tornado genesis. Although mesocyclone inflow was within a variable surface layer 3 to 6 km deep, it concentrated between 1 and 3 km elevation. During the tornadic phase maximum mass flux and angular momentum transport were observed, and the parent mesovortex exhibited features associated with breakdown. GRA

N78-13709# National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs.
SYNOPTIC AND MEAN MONTHLY 20 DEG C TOPOGRAPHIES IN THE EASTERN GULF OF MEXICO
Robert L. Molinari Jun. 1977 38 p
(PB-271677/7; NOAA-TM-ERL-AOML-27; NOAA-77072530)
Avail: NTIS HC A03/MF A01 CSCL 04B

Synoptic and mean monthly 20 C isothermal surface topographies are presented. Historical literature in which many of the synoptic topographies are considered are also listed. Other data representations is given in which the large variability about the climatological averages is indicated. GRA

N78-13710# National Weather Service, Salt Lake City, Utah.
A METHOD FOR TRANSFORMING TEMPERATURE DISTRIBUTIONS TO NORMALITY
Morris S. Webb Jun. 1977 23 p
(PB-271742/9; NOAA-TM-NWS-WR-122; NWS-WR-122; NOAA-77071808) Avail: NTIS HC A02/MF A01 CSCL 04B

A method of transforming and fitting temperature distributions to the normal curve using gamma distribution is presented. The concept of base temperature, which permits the gamma distribution to be used with nonpositive as well as positive values, was introduced. An actual temperature distribution was transformed to normality using steps contained in a program designed to normalize meteorological variates. The resultant normal curve was then used to determine cumulative temperature probabilities. GRA

N78-13711# National Weather Service, Salt Lake City, Utah. Western Region.
CLIMATOLOGICAL PREDICTION OF CUMULONIMBUS CLOUDS IN THE VICINITY OF THE YUCA FLAT WEATHER STATION
R. F. Quiring Jun. 1977 27 p refs
(PB-271704/9; NOAA-NWS-WR-121; NOAA-77071807) Avail: NTIS HC A03/MF A01 CSCL 04B

Climatological information was collected relative to the occurrence and prediction of cumulonimbus clouds (CB) in the vicinity of the Yucca Flat Weather Station. The annual and daily cycles are first described in terms of relative frequency, i.e., the empirical equivalent of probability expressed either as a percentage or decimal fraction. This is followed by details on the persistence of days with CB activity and an evaluation of the predictive value of various climatological indices. GRA

N78-13712# National Center for Atmospheric Research, Boulder, Colo.
JANUARY AND JULY SIMULATION EXPERIMENTS WITH THE 2.5 DEG LATITUDE-LONGITUDE VERSION OF THE NCAR GENERAL CIRCULATION MODEL. VOLUME 1: TEXT. VOLUME 2: FIGURES Final Report
Warren M. Washington, Bette Otto-Bliesner, and Gloria Williamson Jul. 1977 106 p refs
(Contract NSF C-760)
(PB-270679/4; NCAR-TN-123/STR-Vol-1; NCAR-TN-123/STR-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 04B

The capability of the National Center for Atmospheric Research (NCAR), 2.5 degrees latitude-longitude, second-generation, 6-layer

general circulation model to simulate a typical January or July is evaluated. This version is a modification of an NCAR model for which results of similar simulations were published earlier. The new diagnostics are storm tracks for both mountain and no-mountain experiments, soil moisture, snow cover, and energy balance at the earth's surface and model top. To clarify the cause of a deficiency in the temperature distribution, results of additional experiments are included. GRA

N78-13713# Naval Postgraduate School, Monterey, Calif.
DIVERGENT INITIALIZATION EXPERIMENTS USING A SPECTRAL MODEL Technical Report, Oct. 1976 - Jun. 1977
Olaf M. Lubeck, Thomas Rosmond, and R. T. Williams Sep. 1977 82 p refs
(AD-A045559; NPS-63WU7791) Avail: NTIS HC A05/MF A01 CSCL 04/2

An initialization of a spectral formulation of the primitive equations using a diagnostic divergence is tested for a global model. The initial conditions are generated from a developing baroclinically unstable wave. A semi-implicit time scheme is developed and tested along with the usual explicit method during the course of the experiments. Results show a relatively small effect of a divergent initialization on the ensuring integrations. The semi-implicit method shows a tendency to smooth out high frequency oscillations in local tendencies. Author (GRA)

N78-13714# Brookhaven National Lab., Upton, N. Y.
EFFECTS ON ATMOSPHERIC DIFFUSION OF METEOROLOGICAL PROCESSES IN COASTAL ZONES
G. S. Raynor 1977 29 p refs Presented at Cryogenic Eng. Conf., Boulder, Colo., 2 Aug. 1977
(Contract EY-76-C-02-0016)
(BNL-22815; Conf-770801-4) Avail: NTIS HC A03/MF A01

Meteorological processes in coastal zones differ from those inland because of the surface discontinuity between land and water. The difference in heating between the two surfaces gives rise to sea or lake breeze circulations which can transport pollutants in nongradient directions and recirculate them over some source areas. The step change in surface characteristics at the land-water interface also causes formation of internal boundary layers having different transport velocities and diffusion rates than unmodified air upwind or above the boundary. These features require a more extensive measurement program and more versatile diffusion models than at inland sites. ERA

N78-13715# National Center for Atmospheric Research, Boulder, Colo. Atmospheric Analysis and Prediction Div.
A STUDY OF SYNOPTIC AND MESOSCALE INTERACTION OVER THE GATE SHIP NETWORK: 4-5-6 SEPTEMBER 1974
Gordon Dean (Fla. State Univ.) and Clark Smith Jul. 1977 104 p refs
(Grant NSF ATM-72-10157)
(PB-270616/6; NCAR-TN-STR-122) Avail: NTIS HC A06/MF A01 CSCL 04B

During the period 4-5-6 September 1974, several small scale systems developed within the A-B ship array. One of these, on 5 September, was investigated by research aircraft on a basic cloud cluster mission. The four dimensional wind flow patterns given by synoptic streamline fields for 4-6 September 1974 and mesoscale patterns for 5 September are presented. The patterns are related to the cloud and radar echo fields. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N78-13716*# Wentz (Frank J.) and Associates, Cambridge, Mass.
COMPUTATION OF THEORETICAL BRIGHTNESS TEMPERATURES CORRESPONDING TO THE CAPE COD CANAL RADIOMETER MEASUREMENTS Final Report
Frank J. Wentz Nov. 1977 14 p refs
(NASA Order L-24420-A)
(NASA-CR-145277) Avail: NTIS HC A02/MF A01 CSCL 08J

Theoretical brightness temperatures are computed from the ground-truth data that was collected during the radiometer measurements of the Cape Cod Canal. An approximate correction for antenna pattern effects is made, and the results are compared with the radiometer measurements. Author

N78-13717*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MINIMAL-RESOURCE COMPUTER PROGRAM FOR AUTOMATIC GENERATION OF OCEAN WAVE RAY OR CREST DIAGRAMS IN SHOALING WATERS
Lamont R. Poole, Stuart R. LeCroy (Vought Corp., Hampton, Va.), and W. Douglas Morris Dec. 1977 95 p refs
(NASA-TM-74076; L-11818) Avail: NTIS HC A05/MF A01 CSCL 08C

A computer program for studying linear ocean wave refraction is described. The program features random-access modular bathymetry data storage. Three bottom topography approximation techniques are available in the program which provide varying degrees of bathymetry data smoothing. Refraction diagrams are generated automatically and can be displayed graphically in three forms: Ray patterns with specified uniform deepwater ray density, ray patterns with controlled nearshore ray density, or crest patterns constructed by using a cubic polynomial to approximate crest segments between adjacent rays. Author

N78-13718# North Carolina State Univ., Raleigh. Center for Marine and Coastal Studies.
MATHEMATICAL MODEL OF NUTRIENT DISTRIBUTION IN COASTAL WATERS
Eileen E. Hofmann, Leonard J. Pietrafesa, Larry P. Atkinson (Skidaway Inst. of Oceanog.), Gustav-A. Paffenhoefer (Skidaway Inst. of Oceanog.), and William M. Dunstan (Skidaway Inst. of Oceanog.) Feb. 1977 107 p refs
(Contract EY-76-S-09-0902)
(SRO-902-4; Rept-77-2) Avail: NTIS HC A06/MF A01

An approach was developed to biological modelling involving the use of separation transformation theory. By use of the theory, it is possible to reduce the number of independent variables in the system. The original four dimensional system can be reduced to a vertical plane conceptual model by assuming along isobath homogeneity in the flow field as a partial function of the baroclinic flow field. Both temporally dependent and independent nitrate concentration equations are then obtained and solved by conventional approximation methods. This technique has applicability to ecological modelling and results obtained by its use show good agreement with field data. Parameterization of the physical processes shows horizontal diffusion and advection to be the important forces in the system. Scaling of biological dynamics shows nutrient uptake by phytoplankton and detrital decomposition to be the most important biological factors in the system. ERA

N78-13719# Sandia Labs., Albuquerque, N. Mex. Instrumentation Systems Div.
OUTER CONTINENTAL SHELF PROGRAM Quarterly Report, 1 Jan. - 31 Mar. 1977
D. H. Denton Apr. 1977 24 p
(Contract EY-76-C-04-0789)
(SAND-77-0653; QR-1) Avail: NTIS HC A02/MF A01

Development work was done on a long-life, self-contained ocean bottom instrumentation and seismic measurement system. The underwater-acoustic-data-link tests were conducted at Elephant Butte Lake in southern New Mexico. These tests were successful in demonstrating a high-data-rate acoustic transmission technique for transmission of digital data within acceptable performance specifications. Digital data was transmitted at rates in excess of 2500 bits per second (bps) with bit/error rates less than one in one thousand. Development is in progress on a prototype sediment instrumentation package incorporating an acoustic data-transmission link and a limited set of basic sensors for operational testing in the Gulf of Mexico. ERA

N78-13720# Hawaii Inst. of Geophysics, Honolulu.
TRANSPORT THEORY OF LONG SURFACE WAVES. 2: NETWORKS

Rudolph W. Preisendorfer May 1977 179 p refs
(PB-272175/1; HIG-77-6; NOAA-77082519;
NOAA-JTRE-187) Avail: NTIS HC A09/MF A01 CSCL 08C

Long two-dimensional, time-harmonic, surface water waves, protobasins are studied by assembly into networks of basins, in a way that is a direct generalization of the one-dimensional canal network theory. Composition rules are derived which apply to all possible combined configurations of two-dimensional regions of water such as the oceans, seas, bays, and sounds of the world, and yield the associated transfer functions (impedances, admittances) and forced amplitudes emerging from the assembly of basins. The basins may be combined in series or in parallel in any of several ways to form a given whole region. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N78-13721*# National Aeronautics and Space Administration, Washington, D. C.
PRELIMINARY RESULTS OF THE SCIENTIFIC EXPERIMENTS ON THE KOSMOS-936 BIOSATELLITE
Dec. 1977 63 p Transl. into ENGLISH from Predvaritelnyye Rezultaty Nauchnykh Eksperimentov na Biosputnike, Kosmos-936, Russian report (Moscow), 1977 p 1-78 Translated by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Ministry of Health and Interkosmos Council, Academy of Sciences, Moscow
(Contract NASw-2790)
(NASA-TM-75071) Avail: NTIS HC A04/MF A01 CSCL 06C

The scientific equipment and experiments on the Kosmos-936 biosatellite are described, including various ground controls and the lab unit for studies at the descent vehicle landing site. Preliminary results are presented of the physiological experiment with rats, biological experiments with drosophila and higher and lower plants, and radiation physics and radiobiology studies for the planning of biological protection on future space flights. The most significant conclusion from the preliminary data is that rats tolerate space flight better with an artificial force of gravity. Author

N78-13722# Woods Hole Oceanographic Institution, Mass.
MARINE MICROBIOLOGY Final Report
Stanley W. Watson 1977 47 p refs
(Contract EY-76-S-02-3565)
(COO-3565-08) Avail: NTIS HC A03/MF A01

Microorganisms of the marine environment were studied with emphasis on the role of bacteria in the nitrogen cycle, specifically concentrating on the organisms responsible for microbiological oxidation of ammonia to nitrite to nitrate. The distribution rates of in situ reactions, fine structure and biochemical properties of these organisms were detailed. Rates of urea, acetate, and glucose decomposition in both inshore and offshore waters were determined using labelled compounds and the significance of these degradations in the hydrosphere was examined. A new test for the determination of bacterial biomass was developed, and using this test in conjunction with more standard techniques it was demonstrated that bacteria comprised up to 50 percent of the total biomass in the oceans. ERA

N78-13723# Organization for Health Research, TNO, Amsterdam (Netherlands).
[ACTIVITIES OF THE RADIOBIOLOGICAL INSTITUTE, THE INSTITUTE FOR EXPERIMENTAL GERONTOLOGY, AND THE PRIMATE CENTER] Annual Report, 1976
1976 412 p refs
Avail: NTIS HC A18/MF A01

Activities, presented by way of concise articles, cover the following subjects: radiation physics, radiobiology, experimental tumor therapy, tumor induction and tumor biology, immunology, transplantation and immunogenetics, hematology, gerontology, ethology, microbiology and quotobiology, techniques, and animals. ESA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N78-13724*+ National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 173
Nov. 1977 78 p
(NASA-SP-7011(173)) Avail: NTIS E02 CSCL 06E

This bibliography lists 233 reports, articles, and other documents introduced into the NASA scientific and technical information system in October 1977. Author

N78-13725*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Biotechnology Div.
ELECTROLYTIC PRETREATMENT OF URINE
15 Sep. 1977 348 p refs
(Contract NAS1-11662)
(NASA-CR-151566) Avail: NTIS HC A15/MF A01 CSCL 06B

Electrolysis has been under evaluation for several years as a process to pretreat urine for ultimate recovery of potable water in manned spacecraft applications. The conclusions that were drawn from this investigation are the following: (1) A platinum alloy containing 10 percent rhodium has been shown to be an effective, corrosion-resistant anode material for the electrolytic pretreatment of urine. Black platinum has been found to be suitable as a cathode material. (2) The mechanism of the reactions occurring during the electrolysis of urine is two-stage: (a) a total Kjeldahl nitrogen and total organic carbon (TOC) removal in the first stage is the result of electrochemical oxidation of urea to CO_2, H_2O, and ammonia followed by chloride interaction to produce N_2 from ammonia, (b) after the urea has been essentially removed and the chloride ions have no more ammonia to interact with, the chloride ions start to oxidize to higher valence states, thus producing perchlorates. (3) Formation of perchlorates can be suppressed by high/low current operation, elevated temperature, and pH adjustment. (4) UV-radiation showed promise in assisting electrolytic TOC removal in beaker tests, but was not substantiated in limited single cell testing. This may have been due to non-optimum configurations of the single cell test rig and the light source. Author

N78-13726# Stanford Research Inst., Menlo Park, Calif.
ASSESSMENT OF FUTURE NATIONAL AND INTERNATIONAL PROBLEM AREAS. VOLUME 2: THE EFFECTS OF STRESS ON INDIVIDUALS AND SOCIETY
Arnold Mitchell Feb. 1977 41 p refs Sponsored by NSF
(SRI-77-206-Vol-2) Avail: NTIS HC A03/MF A01

Models of stressful situations are presented that suggest the great range of the effects of stress and the complexity of its patterns. Stress can be a very positive force if it serves as a stimulus for people or institutions to grow, face challenge, and achieve greatly. But it can also be a highly destructive force by producing a variety of pathogenic, often enervating responses in individuals and anomie, alienation, or activistic opposition in the larger society. A section dealing with traditional methods of treating stress seeks to show that many aspects of the total stress syndrome (including several of strong relevance to policy makers) receive too little professional attention despite their great importance; some conventional therapies appear actually to worsen rather than aid stress responses; and a variety of nontraditional methods of coping with stress show considerable promise as therapeutic approaches, but tend to be neglected by conventional medical groups. The paper concludes with brief outlines of several research programs aimed at exploring and documenting some of the views tentatively set forth in the body of the discussion. Author

N78-13727# National Academy of Sciences - National Research Council, Washington, D. C. Committee on the Life Sciences and Social Sciences.
ASSESSING BIOMEDICAL TECHNOLOGIES. AN INQUIRY INTO THE NATURE OF THE PROCESS
1 Jul. 1977 127 p

(Contract NSF C-310)
(PB-271162/0; NSF/RA-770114) Avail: NTIS HC A07/MF A01 CSCL 06E

A critical and interpretive synthesis presented of the discussions, background papers, preparatory analyses, and subsequent comments resulting from the Hanover conference. Technologies selected for study include in vitro fertilization of human oocytes and their subsequent nurture and growth; the predetermination of the sex of children; the retardation of aging; and modification of behavior by neurosurgical, electrical, or pharmaceutical means. Each study attempts: (1) to illustrate the range of questions required for a broad analysis of the physiological, psychological, and social implications of the technology; (2) to illuminate some of the major issues at stake; and (3) to identify areas of ignorance requiring further inquiry. GRA

N78-13728# Army Personnel Research Establishment, Farnborough (England).

A POCKET SIZE HEART BEAT RADIO TELEMETER AND SIGNAL DECODER

J. B. Peckham Jun. 1977 44 p refs
(AD-A043587; APRE-Memo-43/76) Avail: NTIS HC A03/MF A01 CSCL 17/2

A prototype heart beat radio telemetry system has been constructed which is suitable for use on soldiers negotiating the Army Personnel Research Establishment (APRE) Agility Course at their best speed. With only one telemeter in use at least 93% of the total number of heart beats made during an average two minute run time were detected. When two telemeters were in use simultaneously the detection efficiency fell to 63%. Interpolation of recordings, however, would count at least 99% of the total number of heart beats made. The design of the circuits is described and possible improvements are discussed.
Author (GRA)

N78-13729# Oak Ridge National Lab., Tenn. Industrial Hygiene Dept.

MATERIALS SAFETY DATA SHEETS: THE BASIS FOR CONTROL OF TOXIC CHEMICALS, VOLUME 2

N. E. Bolton, E. E. Ketchen, W. E. Porter, and C. L. Hunt May 1977 558 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5722) Avail: NTIS HC A24/MF A01

For abstract, see N78-13730.

N78-13730# Oak Ridge National Lab., Tenn. Industrial Hygiene Dept.

MATERIALS SAFETY DATA SHEETS: THE BASIS FOR CONTROL OF TOXIC CHEMICALS, VOLUME 1

N. E. Bolton, E. E. Ketchen, W. E. Porter, and C. L. Hunt May 1977 482 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5721-Vol-1) Avail: NTIS HC A21/MF A01

For large industrial and research operations, maintaining reasonable control of all toxic materials used in their operations can be a formidable task. A system utilizing cards has been developed that serves a dual purpose, informing the user regarding hazards of a particular material and also facilitating appropriate workplace surveillance during its use. Selected data, including threshold limit values, routes of absorption, symptoms of exposure, chronic effects, and emergency first-aid procedures, are printed on the card. A portion of the card contains the label that the user detaches and affixes to the container. This label classifies the material according to flammability, toxicity, reactivity, and special properties on a 0 through 4 hazard rating system. This report describes the development and use of such cards, contains the associated toxic material data sheets that provide full backup data for the labels, and furnishes a glossary of biomedical terms used in the data sheets. ERA

N78-13731# Argonne National Lab., Ill. Div. of Biological and Medical Research.

CIRCADIAN DYSCHRONISM AND CHRONOTYPIC ECOPHILIA AS FACTORS IN AGING AND LONGEVITY

Charles F. Ehret, Kenneth R. Groh, and John C. Meinert 13 Apr. 1977 42 p refs Presented at Conf. on Biol. Rhythms and Aging, Bay Pines, Fla., 13 Apr. 1977
(Contract W-31-109-eng-38)
(CONF-770412-1) Avail: NTIS HC A03/MF A01

Circadian dyschronism is defined as the absence of a strong daily rhythm in an organism where normally one is found, and ecophilia is defined as satisfaction with one's immediate environment. The hypothesis is presented that a creature with all of its systems in strong circadian synchrony has somehow learned how to live so that environmental amenities and inner appetites mesh in circadian harmony, and this is rewarded by functional proficiency and longevity. Circadian dyschronic, on the other hand, suffer the malaise of poor performance in physiological tests, and the ultimate insult of early death. Molecular and physiological studies at cellular and organismic levels are reviewed that appear to be generally applicable to all higher eukaryotic organisms, including man. Maintenance of mental as well as physical activities characterize those who age successfully. ERA

N78-13732# Los Alamos Scientific Lab., N. Mex.

AUTOMATIC DETECTION OF ALTERNATIONS IN PULMONARY VENOUS PRESSURE

T. C. Strand (Univ. of Southern Calif., Los Angeles), A. Franklin Turner (LAC-USC Medical Center, Los Angeles), Richard P. Kruger, Harvey I. Meyers (LAC-USC Medical Center, Los Angeles), and Wissam Ahmed (Univ. of Southern Calif., Los Angeles) 1977 7 p refs Presented at the San Diego Biomedical Symp., San Diego, Calif., 2-4 Feb. 1977
(Contract W-7405-eng-36)
(LA-UR-77-531; Conf-770224-1) Avail: NTIS HC A02/MF A01

A completely automated computer controlled optical system was developed for early detection and classification of prepulmonary edema. Lung vascularity patterns were extracted using the Fraunhofer diffraction pattern sampling unit which samples the Fourier transform and obtains the spatial frequency measurements. A laser is used to illuminate certain zones of the lung, and by passing the image through a thin convex lens the diffraction pattern is produced. An increase in pulmonary venous pressure affects the number of vessels in the upper zone as compared to the number of vessels in the lower zones of the lung and thus change the ring and wedge regions of the transform space. Measurements of the ring and wedge signatures were made on a number of chest radiographs which had been classified by the Turner method as to the presence and extent of pulmonary edema. Preliminary results indicate a classification accuracy on the training data of 90 percent. ERA

N78-13733# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Hamburg (West Germany). Inst. fuer Flugmedizin.

EFFECT OF ACCELERATION ON BRAIN METABOLITES [EINFLUSS DER BESCHLEUNIGUNG AUF STOFFWECHSELMETABOLITEN DES GEHIRNS]

G. Schaefer 1976 9 p refs In GERMAN
(DLR-IB-355-76-05) Avail: NTIS HC A02/MF A01

Acceleration effects (+Gz) were investigated. The fast glutamate depression can be explained only partly by the accompanying gamma amino butyric acid (GABA) increase, the concentration of which depends mainly on enzyme activity converting glutamate into GABA. If one considers that short term heavy hyperoxia at 1 ata, lead to equivalent changes in the concentration of these amino acids, the conclusion may be reached that the oxydative nerve cell normally fixed upon glucose decomposition is based on glutamate as an energy producing substrate by variation of oxygen tension. ESA

N78-13734# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.

PRELIMINARY INVESTIGATION OF USING THE CENTRIFUGE AND LIGHT AIRCRAFT FOR TRAINING PAYLOAD SPECIALISTS [VORUNTERSUCHUNG UEBER DIE MOEGLICHKEIT DES EINSATZES VON ZENTRIFUGE UND LEICHTFLUGZEUG FUER DAS TRAINING VON NUTZLASTEXPERTEN (NE)]

G. Oser, H. Mertens, L. Vogt, and E. Schwartz 1976 8 p refs In GERMAN

(DLR-IB-355-76-06) Avail: NTIS HC A02/MF A01

The possibility of using a centrifuge and a light aircraft for training Spacelab payload specialists was investigated. A centrifuge with an acceleration profile similar to the shuttle reentry was used. Candidates were subjected to +3 Gz for 1 min and then to +2.1 Gz for up to 15 min. The electrocardiogram was recorded and a 6-min alertness test was carried out towards the end of acceleration exposure. Zero-g simulations were carried out in a Piaggio sports aircraft, allowing a zero-g period up to 15 sec during roller coaster flights. The circulatory reactions under zero gravity as well as under increased acceleration are shown to follow an individual pattern. ESA

N78-13735# Stanford Univ., Calif. Stanford Low Temperature Physics Group.

SUPERCONDUCTING MAGNETOMETRY FOR THE DETECTION OF HEART DISEASE Final Technical Report

William M. Fairbank, Donald C. Harrison, and John P. Wikswo, Jr. 1 Jul. 1977 96 p refs

(Grant NSF APR-72-03447)

(PB-271950/8; SLTP-1977-1; NSF/RA-770197) Avail: NTIS HC A05/MF A01 CSCL 06B

Instrumentation is discussed that is capable of efficient recording of high-quality vector magnetocardiograms (VMCG), a data processing facility and software that allows detailed analysis, comparison, and display of the VMCG, and a detailed theoretical understanding of the generation, detection, and analysis of the VMCG. A series of calculations and electrolytic tank studies were performed to clarify the spatial relationship of cardiac current sources to the external magnetic field. A magnetic dipole equivalent source, the magnetic heart vector (MHV), could be determined by a single vector field measurement at a specific point outside the thorax. A sophisticated technique was devised for determining the components and position of the best-fit moving magnetic dipole to study the spatial and temporal variation of the major features of the VMCG. GRA

N78-13736# Columbia Univ., New York. Dept. of Pediatrics.

DEVELOPMENT AND CLINICAL EVALUATION OF BLOOD GAS SENSORS FOR CONTINUOUS MONITORING (ADULT AND NEONATE) Annual Report, May 1976 - Apr. 1977

L. Stanley James and Leonard Indyk Jul. 1977 25 p refs

(Contract N01-HR-5-2948)

(PB-271809/6) Avail: NTIS HC A02/MF A01 CSCL 06K

The clinical evaluation of the performance and efficacy of transcutaneous oxygen sensors is reported. The data recording of several physiological variables in addition to the transcutaneous P02 have enabled demonstration of different patterns of onset and recovery from apnea than is the current accepted model. The availability of the monitoring scheme is extended so that newborns can be monitored within a few minutes after birth and the length observations extended on individual infants to nearly 12 hours. GRA

N78-13737# Joint Publications Research Service, Arlington, Va.

TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: BIOMEDICAL AND BEHAVIORAL SCIENCES, NO. 16

7 Dec. 1977 79 p Transl. into ENGLISH from Selected Foreign Periodicals (USSR)

(JPRS-70297) Avail: NTIS HC A05/MF A01

Information on aerospace medicine, agrotechnology, bionics, bioacoustics, biochemistry, biophysics, environmental and ecological problems, and food technology was reported. Microbiology, epidemiology and immunology, marine biology, military medicine, physiology, public health, and toxicology were also discussed. Reports on radiobiology, veterinary medicine, behavioral science, human engineering, psychology, psychiatry and related fields, were cited along with scientists and scientific organizations in biomedical fields. Author

N78-13738# Joint Publications Research Service, Arlington, Va.

TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: BIOMEDICAL AND BEHAVIORAL SCIENCES, NO. 17

15 Dec. 1977 73 p refs Transl. into ENGLISH from various Russian Journals

(JPRS-70338) Avail: NTIS HC A04/MF A01

Soviet research papers are presented from the fields of aerospace medicine, microbiology, human performance psychology, genetics, agriculture, and veterinary medicine. J.H.

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N78-13739# Naval Air Station, Quonset Point, R.I.

AN INVESTIGATION OF POSSIBLE CORRELATIONS BETWEEN INDIVIDUAL PILOT PERFORMANCE AND NEUROLOGICAL FUNCTIONS Final Report, 1976-1977

Edgar Rogers Enochs 23 May 1977 86 p refs

(AD-A045372; USNA-TSPR-84) Avail: NTIS HC A05/MF A01 CSCL 05/9

The purpose of this study is to determine whether a meaningful correlation exists between some quantifiable element of a pilot's neurological activity and his performance at the controls of an aircraft. A new, unique system for quantifying pilot performance was developed using the Singer GAT-1B Link Flight Simulator. A system was also developed for monitoring and recording pilot neurological functions in a cockpit environment. Significant changes in the pilot performance and neurological functions were observed. An apparent trend was observed also relating changes in pilot performance to changes in a pilot's pre-flight neurological state. Ground work was laid for further investigation into the possibility of predicting pilot performance based on a comparison of the pilot's current neurological state and developing neurologically based criteria for pilot duty cycles. Author (GRA)

N78-13740# Michigan Univ., Ann Arbor. Human Performance Center.

CONSTRAINING NONMETRIC MULTIDIMENSIONAL SCALING CONFIGURATIONS

Elliot Noma and Janice Johnson Aug. 1977 64 p refs

(Contract N00014-76-C-0648)

(AD-A045800; TR-60; TR-014523-3-T) Avail: NTIS HC A04/MF A01 CSCL 05/10

The interpretation of multidimensional scaling outputs is usually based on the identification and labeling of geometric structures in space. Some of the most commonly used structures are reviewed. Interpretation of the scaling outputs requires many psychological and mathematical assumptions including the assumption that the configuration with the lowest stress is the output desired. Unfortunately, little is known about the uniqueness of a configuration generated from fallible data and this nonuniqueness also affects the interpretation of the spatial outputs. A scaling method incorporating information in addition to the dissimilarities is proposed and the implications of this approach for the interpretation of a configuration are discussed.

Author (GRA)

N78-13741# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Hamburg (West Germany). Abt. Luftfahrtpsychologie.

RESEARCH ACTIVITIES OF THE DFVLR DEPARTMENT OF AVIATION PSYCHOLOGY CONCERNING THE CONSULTANCY CONTRACT OF THE DEUTSCHE LUFTHANSA AG Annual Report, 1975 [JAHRESBERICHT 1975 DER ABT. LUFTFAHRTPSYCHOLOGIE ZUM BERATUNGSAUFTRAG DER DEUTSCHEN LUFTHANSA AG]

K. Steininger, N. Adam, S. Fichtbauer, K.-M. Goeters, and H. Kirsch 1976 21 p refs In GERMAN

(DLR-IB-355-76-01) Avail: NTIS HC A02/MF A01

Results of psychological aptitude tests for cockpit personnel selection of the Deutsche Lufthansa are reported for the period January 1975 through December 1975. Further development of the selection system is also discussed. ESA

N78-13742# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Hamburg (West Germany). Abt. Luftfahrtpsychologie.

PSYCHOLOGICAL SELECTION OF APPLICANTS FOR A FLYING CAREER [DIE PSYCHOLOGISCHE AUSWAHL VON BEWERBERN FUER DIE FLIEGERISCHE LAUFBAHN]

Helmut Kirsch 1976 16 p refs In GERMAN

(DLR-IB-355-76-02) Avail: NTIS HC A02/MF A01

Tests for selection of a flight navigator, mechanic, and dispatcher, from applicants without prior training, are described. These tests are psychologically based in view of the considerable personal demands on trainees. It has been noted that after selection about 94% of the trainees successfully terminate the courses. ESA

N78-13743# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Hamburg (West Germany). Abt. Luftfahrtpsychologie.

INVESTIGATION OF PERSONALITY CHARACTERISTICS OF FLIGHT TRAINEES AND PROFESSIONAL PILOTS [DIE UNTERSUCHUNG VON PERSOENLICHKEITSMERKMALEN BEI FLUGSCHUELERN UND BERUFSPILOTEN]

Helmut Kirsch 1976 40 p refs In GERMAN

(DLR-IB-355-76-03) Avail: NTIS HC A03/MF A01

Tests for determining the difference in personality between flight trainees and professional pilots are described. The personality characteristics of typical pilots were found to be: emotional stability, tendency towards performance, tendency towards dominance, enterprise, vitality, average behavioral control, and independence. Technical and sporting natures dominate, whereas musical and literary activities are less. ESA

N78-13744# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Hamburg (West Germany). Abt. Luftfahrtpsychologie.

SELECTION STRATEGY AND PSYCHOLOGICAL TESTS FOR APTITUDE INVESTIGATION OF APPLICANTS FOR PILOT TRAINING AT THE DEUTSCHE LUFTHANSA [SELEKTIONSSTRATEGIE UND PSYCHOLOGISCHE TESTS BEI DER EIGNUNGSUNTERSUCHUNG VON BEWERBERN FUER DIE FLIEGERISCHE AUSBILDUNG BEI DER DLH]

Helmut Kirsch 1976 20 p refs In GERMAN

(DLR-IB-355-76-04) Avail: NTIS HC A02/MF A01

Selection of applicants for pilot training at the Deutsche Lufthansa is described. This is carried out in several steps, the most important of which are preselection and interview. The preselection is objective and based on degree of aptitude, which results from weighing of separate test results covering cognitive tests, personality scales, and psychomotor tests. The next phase covers the applicant's personality. The last step is an evaluation of the applicant in the following categories: interactive performance, adaptation, stress resistance, and motivation. ESA

N78-13745# Air Force Academy, Colo. Dept. of Life and Behavioral Sciences.

BEHAVIORAL AND PHYSIOLOGICAL CORRELATES OF VARYING NOISE ENVIRONMENTS

Lawrence F. Sharp, John F. Swiney, Mickey R. Dansby, Stephen C. Hyatt, and Dale E. Schimmel Jun. 1977 81 p refs

(EPA-iA-G-D4-0537)

(PB-271713/0; EPA-600/1-77-038) Avail: NTIS HC A05/MF A01 CSCL 05J

The research was conceived and conducted to: (1) specifically assess a noise profile to which a large proportion of both urban and suburban dwellers are exposed on a daily basis; (2) examine these effects on a relatively homogeneous population with respect to sex, age, physical fitness, intellectual ability, psychological structure, and environmental stress; and (3) provide more adequate control in terms of research design, of individual differences which could potentially contribute to between group differences in noise responses. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N78-13746*# Cooper (George E.), Saratoga, Calif.

A SURVEY OF THE STATUS OF AND PHILOSOPHIES RELATING TO COCKPIT WARNING SYSTEMS

George E. Cooper Jun. 1977 47 p refs

(Contract NAS2-9117)

(NASA-CR-152071) Avail: NTIS HC A03/MF A01 CSCL 05E

A survey was taken to study current cockpit caution and warning (c/w) systems, and to examine industry philosophies regarding c/w system design including current efforts to improve them. Guidelines currently in use were outlined and those which appear to have general acceptance, those which are considered ineffective or erroneous, and those with which there is broad disagreement as to validity, were delineated. Major airplane manufacturerd were surveyed and a manufacturer dealing specifically with aircraft instrumentation was consulted. Author

N78-13747*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Biotechnology Dept.

GENERALIZED ENVIRONMENTAL CONTROL AND LIFE SUPPORT SYSTEM COMPUTER PROGRAM (G189A) CONFIGURATION CONTROL, PHASE 2 Final Report

R. E. McEnulty Nov. 1977 18 p refs

(Contract NAS9-14877)

(NASA-CR-151567; MDC-G7254) Avail: NTIS HC A02/MF A01 CSCL 06K

The G189A simulation of the Shuttle Orbiter ECLSS was upgraded. All simulation library versions and simulation models were converted from the EXEC2 to the EXEC8 computer system and a new program, G189PL, was added to the combination master program library. The program permits the post-plotting of up to 100 frames of plot data over any time interval of a G189 simulation run. The overlay structure of the G189A simulations were restructured for the purpose of conserving computer core requirements and minimizing run time requirements. Author

N78-13748# Omnemii, Inc., Vienna, Va.

MANNED SYSTEM PERFORMANCE AS A FUNCTION OF DISPLAY CHARACTERISTICS Technical Report, 1 Apr. 1975 - 31 May 1977

Edward M. Connelly Jun. 1977 89 p refs

(Contract N00014-75-C-0810; NR Proj. 197-030)

(AD-A045488; OTR-62-77-1) Avail: NTIS HC A05/MF A01 CSCL 09/4

In manned systems, performance can change significantly with changes in display design. With today's computer and display technology, it is possible to provide virtually any display function desired including automating many of the information processing tasks previously preformed by the human operator. However, the relationship between display design and total system (man and machine) performance must be known in order to systematically select the display features. A new human operator modeling technique termed 'operator measures and criteria' (OMAC) was used to represent the ship control performance of the Officer of the Deck (OOD). OMAC's are measures and criteria which are determined by calculation to be those optimized by the observed OOD controlled ship responses. OMAC's were determined from data obtained from an experiment in which three different displays were used. With each of those displays, OOD subjects demonstrating superior performance resulted in identical criteria, but an apparently self-imposed constraint called purview (range from own ship within which contacts are processed by the OOD) was shown to be different for each display type. Purview is shown to explain differences in performance with different displays. The proportion of OOD subjects demonstrating superior performance is also shown to be a function of display type.

Author (GRA)

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N78-13749 British Library Lending Div., Boston Spa (England).
ON THE SIMULATION OF LARGE-SIGNAL TRANSISTOR EQUIVALENT-CIRCUIT DIAGRAMS IN AN ANALOG COMPUTER
D. Adolphs May 1977 20 p refs Transl. into ENGLISH from Nachrichtentech. Z. (West Ger.), v. 21, no. 12, 1968 p 772-777
(BLL-RTS-10539) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

A large-signal transistor equivalent-circuit diagram suitable for the analysis of digital circuits in which the transistor voltages (base-emitter voltage, collector-emitter voltage) must be considered and the simulation of this diagram in the analog computer, is described. When used for such purposes the transistor equivalent-circuit diagram must be sufficiently accurate in its reproduction not only of the dynamic but also of the static characteristics. Author

N78-13750*# Decision Science, Inc., San Diego, Calif.
USE OF SENSITIVITY ANALYSIS TO PREDICT PILOT PERFORMANCE AS A FUNCTION OF DIFFERENT DISPLAYS Final Report
Michael L. Mout, George H. Burgin, and Michael J. Walsh Nov. 1977 83 p refs
(Contract NAS1-14416)
(NASA-CR-2906) Avail: NTIS HC A05/MF A01 CSCL 09B

A technique for objectively evaluating different displays by sensitivity analysis is described. First, the mathematical model used to analyze static displays is developed. The technique is based on formulating functional relationships between the state variables and the variables observable in the display. The matrix of the partial derivatives of the display variables with respect to the state variables, together with the observer's acuity function, is used to calculate expected errors in the state vector estimation. The technique is expanded by the use of Kalman filtering to process a time series of observation vectors. This provides a tool for analyzing displays of dynamic processes by means of a dynamic display evaluation computer program. Results are reported using this program to simulate an Instrument Landing System approach. Author

N78-13751# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A DIGITAL MICROPROCESSOR CHANNEL VOCODER
Jerzy Gorski-Popiel 10 Aug. 1977 90 p refs
(Contract F19628-76-C-0002)
(AD-A045079; TN-1977-33; ESD-TR-77-193) Avail: NTIS HC A05/MF A01 CSCL 09/5

A complete, real-time, channel vocoder delivering good speech quality with a 2400-bit/second data transmission rate was implemented using purely digital circuitry in the form of a high-speed programmed microprocessor. Necessary algorithms are presented and their effect on the machine design is discussed in detail. The end product is a very high-speed computing machine (measured in program throughput terms). It turned out to have a high degree of programming flexibility, which would make it adaptable to other tasks. This was a bonus, not an original goal. The project was conceived and successfully realized as the most practical way to build a vocoder for actual use in the LES-8/9 satellite communications system. Author (GRA)

N78-13752# Illinois Univ., Urbana-Champaign. Dept. of Computer Science.
BLOCK SUM REGISTER AND BURST ARITHMETIC M.S. Thesis
James Hsioh-Cheng Ma Aug. 1977 31 p refs
(Contract N00014-75-C-0982)
(AD-A045312; UIUCDCS-R-77-890; UILU-ENG-77-1746) Avail: NTIS HC A03/MF A01 CSCL 09/2

The Block Sum Register (BSR) is a basic building block used in Burst Processing. The main difficulty with it has been the large number of discrete components required for the current sources. The paper introduces various BSR designs with considerably smaller numbers of discrete components using the electrical characteristics of the BSR's shift register. The best design is then used in an arithmetic unit which performs the basic arithmetic operations, i.e., addition, subtraction, multiplication and division. Author (GRA)

N78-13753# Sharp (I.P.) Associates Ltd., Ottawa (Ontario).
ON SPECIFYING THE FUNCTIONAL DESIGN FOR A PROTECTED DMS TOOL
Gillian Kirkby and Michael Grohn Mar. 1977 295 p refs
(Contract F19628-76-C-0025; AF Proj. 2801)
(AD-A045537; ESD-TR-77-140) Avail: NTIS HC A13/MF A01 CSCL 05/2

A top level functional design for a secure relational data base system is described, which addresses the multi-level data sharing problem. The system consists essentially of isolated user working areas, hidden security kernel mechanisms, and a multi-level data base. Mathematical (Parnas) specifications are included for all primitive functions of the secure DMS. Author (GRA)

N78-13754# Michigan Univ., Ann Arbor. Systems Engineering Lab.
A METHODOLOGY FOR DATA BASE DESIGN IN A PAGING ENVIRONMENT Interim Report, 1 Oct. 1975 - 1 May 1977
Elias Berelian and Keki B. Irani Sep. 1977 302 p refs
(Contract F30602-76-C-0029; AF Proj. 5581)
(AD-A045544; RADC-TR-77-292) Avail: NTIS HC A14/MF A01 CSCL 05/2

Report is concerned with the development of a methodology for partially automating the design of the logical structure of a paged data base. The approach is to map a high-level description of user requirements in terms of individual data items and binary relations into a set of record structures and record relationships. Subject to storage and security constraints, the goal is to produce a minimum number of page faults for a pre-specified set of user activities. Author (GRA)

N78-13755# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
AN ANALYSIS OF COMPUTER DECENTRALIZATION B.S. Thesis
Cecilia R. DOliveira Oct. 1977 64 p refs
(Contract N00014-75-C-0661; ARPA Order 2095)
(AD-A045526; MIT-LCS-TM-90) Avail: NTIS HC A04/MF A01 CSCL 09/2

The author conjectures that there are strong forces in many organizations leading towards computer facility decentralization, which have been held in check by technological and economic constraints that are beginning to relax. This conjecture is explored

by analyzing approximately forty case studies of decentralization decisions. Results indicate that (1) strong decentralization forces exist in many organizations. The forces derived from these particular case studies are classified as either functional, economic or psychological. (2) The drop in hardware costs allows decentralization to occur at the initiative of lower level managers. The consequences of this trend could include disintegration of the organization's information system. Decisions by lower level managers may overlook the technological constraints of decentralization, especially the problems of networking loosely coupled computers. This could result in a future inability to share data or programs among organizational units. Because of the many functional advantages it provides, management should not discourage decentralization; however, top level management must be aware that technological constraints require that decentralization occur with their guidance and their perspective of the entire organization. GRA

N78-13756# Computer Corp. of America, Cambridge, Mass.
VERY LARGE DATABASES Final Technical Report, 1 Jul. 1976 - 30 Jun. 1977
Robert H. Dorin and Joanne Z. Sattley 30 Aug. 1977 98 p refs
(Contract N00014-76-C-0991)
(AD-A045623; CCA-77-10) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report summarizes work performed under the ARPA Very Large Databases program. Section 1 describes the Datacomputer Technology Transfer project (DTT). This project was aimed at expansion of the Datacomputer user community by increasing the awareness of this unique tool in the government community. The result of this project was a substantial increase in Datacomputer utilization. Section 2 describes the Message Archiving and Retrieval System (MARS) project. The MARS effort was directed toward the design and implementation of a prototype system to provide economical storage and convenient retrieval of Arpanet mail. The system has been fully implemented and is operational at CCA on an experimental basis. This report describes the MARS prototype as well as concepts for future extensions of the system. GRA

N78-13757# Sanders Associates, Inc., Nashua, N. H.
SENSOR DATA CORRELATION SYSTEM DEVELOPMENT, VOLUME 1 Final Technical Report, 9 Jun. 1975 - 8 Feb. 1976
James L. Burrows and Wilfred E. Reynolds Griffiss AFB, N. Y. RADC Jul. 1977 143 p refs
(Contract F30602-75-C-0304)
(AD-A045541; SAN-GA-76-067-2-Vol-1; RADC-TR-76-243-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 09/2

This report describes components of an associative/parallel processor system configured to provide rapid correlation of input data at a four megalyte-per-second data rate. The system permits correlation criteria to be entered via CRT terminal, and displays retrieved records or summaries on the same terminal. Author (GRA)

N78-13758# Sandia Labs., Albuquerque, N. Mex. Applied Mathematics Div.
XPPLOT: AN EXTENDED PRINTER AND TERMINAL PLOT ROUTINE
Rondall E. Jones Jan. 1977 55 p refs
(Contract EY-76-C-04-0789)
(SAND-76-0361) Avail: NTIS HC A04/MF A01

XPPLOT is a stand-alone printer and data terminal plot routine with an adjustable size plot area, the ability to plot up to four curves on one plot, a variety of options or adjustments for labeling, grid lines, and axes, plus vertical and horizontal bar graph modes. XPPLOT is written in FORTRAN and is almost totally independent of the computer or output device used. ERA

N78-13759# Philips Data Systems B. V., Apeldoorn (Netherlands).
STUDY OF ON-BOARD COMPUTER SYSTEMS FOR LONG LIFETIME SATELLITES. VOLUME 1: SURVEY OF MICROPROCESSORS Final Report
H. Bleeker, F. Pool, F. Schiereck, A. Raap, and H. Tromp 1977 161 p refs 4 Vol.
(Contract ESTEC-2568/75-HP)
(ESA-CR(P)-994-Vol-1) Avail: NTIS HC A08/MF A01

A survey is presented of commercially available microprocessors and bit slices, updated to May 1976. This information will be used as a technological basis for the architecture activities on main options for onboard computer applications. ESA

N78-13760# Philips Data Systems B. V., Apeldoorn (Netherlands).
STUDY OF ON-BOARD COMPUTER SYSTEMS FOR LONG LIFETIME SATELLITES. VOLUME 2: TASK ANALYSIS Final Report
F. Krutzen and H. Sprengers Paris ESA 1977 162 p refs 4 Vol.
(Contract ESTEC-2568/75-HP)
(ESA-CR(P)-994-Vol-2) Avail: NTIS HC A08/MF A01

The tasks to be performed by a computer onboard a spacecraft are analyzed. Several task packages are distinguished: TTC, power subsystem, attitude control system, and experiment data processing. The tasks are described and clarified by flow charts. ESA

N78-13761# Philips Data Systems B. V., Apeldoorn (Netherlands).
STUDY OF ON-BOARD COMPUTER SYSTEMS FOR LONG LIFETIME SATELLITES. VOLUME 3: PROCESSING SYSTEMS. MAIN OPTIONS Final Report
H. Sprengers, B. Drost, F. Krutzen, W. Maarschalk, G. Spoelder, and J. L. vanWeelden Paris ESA 1977 252 p refs 4 Vol.
(Contract ESTEC-2568/75-HP)
(ESA-CR(P)-994-Vol-3) Avail: NTIS HC A02/MF A01

A number of onboard microprocessor configurations is presented. These configurations are based on selected microprocessors resulting from a survey and the tasks resulting from a task analysis. In order to point out architectural differences, the selected microprocessors are described in an identical way. Generally possible microprocessor configurations are discussed, and the preferred configurations are presented. Two of the eight selected microprocessors (Signetics 2650 and TMS 9900) were implemented in a few optional structures. An evaluation is given of the resulting main options. ESA

N78-13762# Hollandse Signaalapparaten N. V., Hengelo (Netherlands).
STUDY OF ON-BOARD COMPUTER SYSTEMS FOR LONG LIFETIME SATELLITES. VOLUME 4: PROCESSING SYSTEMS. FURTHER SYSTEM DEFINITION Final Report
F. Krutzen, W. Maarschalk, H. Sprengers, and J. L. vanWeelden Paris 1977 132 p refs 4 Vol.
(Contract ESTEC-2568/75-HP)
(ESA-CR(P)-994-Vol-4) Avail: NTIS HC A07/MF A01

A selected onboard microprocessor system using the Texas Instruments TMS 9900 microprocessor, based on a system option in which the hardware structure is centralized, is defined in more detail; the processing is dynamic and the executive is democratic. The cache memory and its implementation are given a general description. A justification is provided for the absence of local memories in the selected system option. A detailed configuration of the hardware and related signal timing is described, together with an estimation of weight, dissipation, and volume. Possible system extensions and constraints are discussed. Systems software is outlined, and an estimate is given for the maximum number of processors which can be applied. Memory reconfiguration in the case of processor failure is considered. ESA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N78-13763 California Univ., Berkeley.
A STUDY OF MEMORY MANAGEMENT ALGORITHMS AND PERFORMANCE MEASURES Ph.D. Thesis

Mark Harry Liu 1976 206 p
Avail: Univ. Microfilms Order No. 77-15767

Several different models of multiprogrammed virtual memory systems were simulated. It was shown that the problems of performance optimization for systems with time-variant and time-invariant workloads have significantly different solutions. Also, the average space time product of the processes of the workload is a good measure for system performance.
Dissert. Abstr.

N78-13764 Virginia Polytechnic Inst. and State Univ., Blacksburg.
TRACKING MANEUVERING TARGETS VIA SEMI-MARKOV MANEUVER MODELING Ph.D. Thesis
Norman Hamilton Gholson 1977 105 p
Avail: Univ. Microfilms Order No. 77-20238

Adaptive algorithms for state estimation are currently of tremendous interest. Such estimation techniques have particular military usefulness in automatic gunfire control systems. The conventional Kalman filter, optimally solves the state estimation problem concerning linear systems with Gaussian disturbance and error processes. The maneuvering target tracking problem generally involves nonlinear system properties as well as non-Gaussian disturbance processes. An adaptive state estimator centered about the familiar Kalman filter was developed for applications in three-dimensional maneuvering target tracking. Target maneuvers were modeled in a general manner by a semi-Markov process. Dissert. Abstr.

N78-13765*# Stanford Univ., Calif. Joint Inst. for Aeronautics and Acoustics.
MULTI-CALCULATION RATE SIMULATIONS Final Report
J. David Powell and Mahboob Akhter Nov. 1977 59 p refs
(Grant NsG-2250)
(NASA-CR-155335) Avail: NTIS HC A04/MF A01 CSCL 09B

It is common in real time simulations of large aerospace systems to separate the high and low frequency subsystems within the simulation and perform the integrations of the subsystems at different calculation rates. This is done to strike a balance between accuracy of calculation and capacity of the digital computer. Questions arising as to the accuracy of this structure compared to single calculation rates were studied using a linear aircraft model. Also investigated were interactions arising to cause errors worse than those expected. Problems are specifically identified and guidelines are given for selection of sample rates for multiple rate simulations. Author

N78-13766# Stanford Univ., Calif. Dept. of Computer Science.
SAIL
John F. Reiser Aug. 1976 183 p
(Contract MDA903-76-C-0206)
(AD-A045102; SU-STAN-CS-76-574; AIM-289) Avail: NTIS HC A09/MF A01 CSCL 09/2

Sail is a high-level programming language for the PDP-10 computer. It includes an extended ALGOL 60 compiler and a companion set of execution-time routines. In addition to ALGOL, the language features: (1) flexible linking to hand-coded machine language algorithms, (2) complete access to the PDP-10 L/O facilities, (3) a complete system of compile-time arithmetic and logic as well as a flexible macro system, (4) a high-level debugger, (5) records and references, (6) sets and lists, (7) an associative data structure, (8) independent processes, (9) procedure variables, (10) user modifiable error handling, (11) backtracking, and (12) interrupt facilities. This manual describes the Sail language and the execution-time routines for the typical Sail user: a non-novice programmer with some knowledge of ALGOL. It lies somewhere between being a tutorial and a reference manual. Author (GRA)

N78-13767# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
TIVAR: A COMPUTER PROGRAM FOR PREDICTING ENSEMBLE STATISTICS IN A TIME-VARYING MAN/MACHINE CONTROL TASK
David L. Kleinman, Sheldon Baron, and Jeffrey E. Berliner 15 Jul. 1977 146 p
(Contract DAAH01-76-C-0194; DA Proj. 1L3-62303-A-214)
(AD-A045036; BBN-3464; DRDMI-TD-CR-77-4) Avail: NTIS HC A07/MF A01 CSCL 09/2

This report gives the problem formulation, the methods by which system parameters can be changed, the input deck setup, a description of the TIVAR subroutines, and a sample problem with its solution. The report also includes a description of and instructions for using the auxiliary gain computation program GNPROP. Author (GRA)

N78-13768# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
MCARLO: A COMPUTER PROGRAM FOR GENERATING MONTE-CARLO TRAJECTORIES IN A TIME-VARYING MAN/MACHINE CONTROL TASK
David L. Kleinman, Sheldon Baron, and Jeffrey E. Berliner 10 Jun. 1977 111 p
(Contract DAAH01-76-C-0194)
(AD-A045037; BBN-3463; DRDMI-TD-CR-77-2) Avail: NTIS HC A06/MF A01 CSCL 09/2

MCARLO is a computer program for generating time histories of pertinent variables in a man-machine control task. The optimal control model forms the basis for the Monte-Carlo simulation equations. This report gives the modeling formulation and requisite discretization of the equations, a description of the MCARLO subroutines, and input deck setup and a sample problem with solution. Author (GRA)

N78-13769# Naval Postgraduate School, Monterey, Calif.
AN EXPERIMENT IN SOFTWARE ERROR OCCURRENCE AND DETECTION M.S. Thesis
Heinz-Michael Hoffmann Jun. 1977 320 p refs
(AD-A045031) Avail: NTIS HC A14/MF A01 CSCL 09/2

The occurrence and detection of software errors was studied in four software projects. Errors were analyzed with respect to complexity measures of individual subroutines. This paper also provides definitions of error categories and types. The detailed documentation of the software production effort allowed both a qualitative and quantitative analysis of software errors with respect to error types. Author (GRA)

N78-13770# RAND Corp., Santa Monica, Calif.
A GUIDE TO NED: A NEW ON-LINE COMPUTER EDITOR Interim Report
Jeanne Kelly Jul. 1977 45 p
(Contract DAHC15-73-C-0181; ARPA Order 189)
(AD-A045157; R-2000-ARPA) Avail: NTIS HC A03/MF A01 CSCL 05/2

This report provides a step-by-step guide for using the New Editor (NED), a computer program developed at Rand to create and modify text from a cathode ray tube (CRT) terminal. Written in systems programming language C, NED is accessed using modified Ann Arbor Model K4080 D terminals, which are supported by the UNIX timesharing operating system. This report shows the user how to use NED to take advantage of the CRT's screen, keyboard, and cursor and demonstrates the unique features of NED, using easy-to follow exercises. The techniques of using NED are described in detail from logging on to the computer through terminating the session. Also included is an example of editing text filled with typical errors. GRA

N78-13771# Sacramento Air Materiel Area, McClellan AFB, Calif. Data Automation Branch.
SOFTWARE ENGINEERING TECHNIQUES IN COMPUTER SYSTEMS DEVELOPMENT Final Report
John H. Lehman 15 Dec. 1976 51 p
(AD-A045274; SM-ALC/ACD-76-04) Avail: NTIS HC A04/MF A01 CSCL 09/2

This case study centers on the effort involved in the development of a major logistics software system. The development effort was unique in several major respects. It is divided into three general groupings. The first is historical and describes in the most general terms the system itself. The history predates the development effort by some months and terminates roughly with the certification of its initial phase. The second part centers on a review and evaluation, not of the system, but of the procedures followed in its development. This evaluation is almost totally derived from commentaries, both written and oral, of the participants. The final third of the text provides suggestions which the author hopes will prove useful in the development of the future phases of the System or totally new

software development efforts undertaken at the Sacramento Air Logistics Center. Author (GRA)

N78-13772# California Univ., San Francisco.
GUIDE TO 8080 PILOT, VERSION 1.1. Final Report
John A. Starkweather Mar. 1977 42 p
(PB-270715/6; NLM-LHC-77-04) Avail: NTIS HC A03/MF A01 CSCL 09B

A programming system for controlling interactive conversion is described. It is used as an authoring language for computer-assisted instruction, was first developed at U.C. San Francisco, and is implemented on a variety of large and small computers. Operating procedures for a version of Pilot that will run on computers using the Intel 8080 microprocessor are included. It is an interpreter written in assembly language that requires less than 4K bytes of memory for the interpreter code. GRA

N78-13773# National Bureau of Standards, Washington, D. C. Inst. for Computer Sciences and Technology.
A SURVEY OF ELEVEN GOVERNMENT-DEVELOPED DATA ELEMENT DICTIONARY/DIRECTORY SYSTEMS
Hazel McEwen Aug. 1977 114 p
(PB-270724/8; NBS-Special Pub-500-16; LCC-77-608155) Avail: NTIS HC A06/MF A01 CSCL 09B

The current state-of-the-art of government developed Data Element Dictionary/Directory (DED/D) systems is presented. DED/D's are software tools used for managing and controlling information and data. Eleven DED/D systems are described, first using a side-by-side features presentation approach, and followed by narrative systems descriptions which highlight special capabilities and experiences with each system. GRA

N78-13774# National Bureau of Standards, Washington, D. C.
OMNITAB 2 USERS MANUAL 1977 SUPPLEMENT Final Report
David Hogben and Sally J. Peavy Jul. 1977 177 p Sponsored in part by Natl. Highway Traffic Safety Admin., Wash., D.C.
(PB-270855/0; NBSIR-77-1276) Avail: NTIS HC A09/MF A01 CSCL 09B

Additions and improvements made to the OMNITAB 2 computing system at NBS since 1970 are described. Major new capabilities now exist in the following areas: use of labels, table making, plotting, numerical analysis, editing of data, stem-and-leaf displays, selection of variables in linear regression and probability plotting. GRA

N78-13775# Stanford Univ., Calif. Dept. of Computer Science.
A PRACTICAL FORMAL SEMANTIC DEFINITION AND VERIFICATION SYSTEM FOR TYPED LISP Ph.D. Thesis
Robert Cartwright, Jr. Dec. 1976 160 p
(Contract MDA903-76-C-0206; ARPA Order 2494)
(AD-A045722; STAN-CS-77-592; AIM-296) Avail: NTIS HC A08/MF A01 CSCL 09/2

Despite the fact that computer scientists have developed a variety of formal methods for proving computer programs correct, the formal verification of a non-trivial program is still a formidable task. Moreover, the notion of proof is so imprecise in most existing verification systems, that the validity of the proofs generated is open to question. With an aim toward rectifying these problems, the research discussed in this dissertation attempts to accomplish the following objectives: (1) To develop a programming language which is sufficiently powerful to express many interesting algorithms clearly and succintly, yet simple enough to have a tractable formal semantic definition. (2) To completely specify both proof theoretic and model theoretic formal semantics for this language using the simplest possible abstractions. (3) To develop an interactive program verification system for the language which automatically performs as many of the straightforward steps in a verification as possible. GRA

N78-13776# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
A PRE-PROCESSOR FOR A STRUCTURED VERSION OF COBOL M.S. Thesis
Robert Clifford Hilb 17 Mar. 1977 78 p refs
(AD-A045415; AFIT-CI-77-55) Avail: NTIS MF A01 CSCL 09/2

A version of COBOL that permits structured programming was designed. It was implemented using a pre-processor that outputs standard COBOL. The pre-processor will indiscriminately run programs that are either structured or nonstructured, or with very limited restrictions, programs with a mixture of both. A structured IF was included as a modification of the COBOL IF. In line looping was created with a redefinition of the PERFORM, maintaining all of its capabilities and adding a DO UNTIL. The PERFORM was also modified to allow a CASE construct. All new structures are completely nestable. Author (GRA)

N78-13777# California Univ., Berkeley. Electronics Research Lab.
RESOURCE ALLOCATION IN THE PIPELINED SYSTEM Final Report, 1 Jun. 1973 - 31 Dec. 1976
C. V. Ramamoorthy 31 Dec. 1976 18 p refs
(Grant DA-ARO(D)-31-124-73-G157)
(AD-A045861) Avail: NTIS HC A02/MF A01 CSCL 09/2

Pipelining, parallel processing and memory organization techniques to improve the capability of computer systems are investigated. In pipelining, results obtained pertain to the modelling, sequencing control, design methods and resource allocation problems of generalized pipeline systems. In parallel processing, language constructs which would constraint the programmer to write parallel programs more amenable to analysis and efficient execution are proposed and a scheme to detect and control the parallel execution of sequentially organized programs is also developed. Finally, a scheme using intelligent buffers to improve the performance of interleaved memory is developed and analyzed. GRA

N78-13778# Duke Univ., Durham, N. C. Dept. of Electrical Engineering.
EQN MODELS FOR THE ANALYSIS AND DESIGN OF A COMPUTER NETWORK OF FUNCTIONALIZED PROCESSORS Final Report, 15 Jul. 1976 - 30 Aug. 1977 Ph.D. Thesis
Robert L. Leech 30 Jul. 1977 200 p refs
(Grant DAAG29-76-G-0309)
(AD-A045721; ARO-14533.1-A-EL) Avail: NTIS HC A09/MF A01 CSCL 09/2

Network Queuing Theory is used to establish three Exponential Queuing Network (EQN) models of computer network systems. A projected computer network is based on the specification of processing functions for model representation. Example functions used in this work are computation, data base management, communications and terminal/access interface as would be applicable to a military command and control computer system. The models may be used for trade-off analysis of critical performance criteria. Additionally, a basic method for the synthesis/determination (design) of processor computer power to ensure a load balanced network is ascertained. The three models and their respective computer network evaluations for trade-off analysis are pursued with their inherent advantages and disadvantages. All three models accommodate job routes (types) with one model providing exact solutions for each job type. These models accommodate large numbers of jobs so that an effective total computer network may be modelled. GRA

N78-13779# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
MACRO INSTRUCTIONS AND THEIR PROCESSOR FOR STRUCTURED PROGRAMMING WITH ASSEMBLY LANGUAGES
S. W. Kahng Jun. 1977 39 p refs
(Contract N00017-72-C-4401)
(AD-A045472; APL/JHU/TG-1308) Avail: NTIS HC A03/MF A01 CSCL 09/2

The description of macro instruction for structured programming and the organization of their processor are presented. The macro instructions generate if-then-else, repeat-while, and for statements with the assembly language programming, and the processor translates these macro statements into the assembly codes. Author (GRA)

N78-13780# Naval Surface Weapons Center, Dahlgren, Va.
AN INFORMAL INVESTIGATION INTO SOFTWARE ENGINEERING AS APPLIED TO A COMPILER BOOTSTRAPPING PROJECT Final Report

John G. Perry, Jr. Apr. 1977 61 p refs
(AD-A045876; NSWC/DL-TR-3625) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report describes in detail the necessary steps involved and the problem areas discovered in transporting (bootstrapping) the UNIVAC 1108 SIMPL-T compiler to a CDC 6700 computer system. SIMPL-T is an elementary procedure-oriented language that conforms to the standards of structured programming and modular design. Certain informal experiments relating to software engineering were conducted during this project. A brief summary of software engineering experiments and results follows. A detailed log of the man-hours of work needed to complete this task was partitioned according to the following categories: design (22 percent), coding (23 percent), testing (45 percent), and other (10 percent). The initial manpower estimates were low by about 17 percent. Both the use of a 'program description language' and a 'high level programming language' appear to have improved programmer productivity. Also, error analysis indicated that the number of errors made per line of code for high level lines of code (SIMPL-T) and assembly lines of code (COMPASS) was about the same. Author (GRA)

N78-13781# University of Southern Calif., Marina del Rey. Information Sciences Inst.
A RESEARCH PROGRAM IN COMPUTER TECHNOLOGY Annual Technical Report, Jul. 1976 - Jun. 1977
Sep. 1977 113 p refs
(Contract DAHC15-72-C-0308; ARPA Order 2223)
(AD-A045673; ISI/SR-77-8) Avail: NTIS HC A06/MF A01 CSCL 09/2

This report summarizes the research performed under Contract DAHC15-72-C-0308 by USC/Information Sciences Institute from 1 July 1976 to 30 June 1977. The research is aimed at applying computer science and technology to areas of high DoD/military impact. The ISI program consists of eleven research areas: Program Verification - logical proof of program validity; Information Automation - development of a user-oriented message service for large-scale military requirements; Specification Acquisition from Experts - the study of acquiring and using program knowledge for making informal program specifications more precise; Network Secure Communication - work on low-bandwidth secure voice transmission using an asynchronous packet-switched network; Command and Control Graphics - development of a device-independent graphic system and graphics-oriented command and control applications programs; Programming Research Instrument - development of a major time-shared microprogramming facility; Protection Analysis - methods of assessing the viability of security mechanisms of operating systems; Distributed Sensors Network - developing algorithms and communication protocols to support the operation of geographically distributed sensors; Packet Radio Terminal Mockup - development of a mockup of a minimum-size, low-power display terminal to illuminate human factors issues in portable environments; User-Dedicated Resource - assistance to a documentation for ARPANET users worldwide; and ARPANET TENEX Service - operation of TENEX service and continuing development of advanced support equipment.
Author (GRA)

N78-13782# Illinois Univ., Urbana-Champaign. Dept. of Computer Science.
GIMLI AND GIML: A MACHINE AND PROGRAMMING LANGUAGE FOR LOW COST INTERACTIVE GRAPHICAL SYSTEMS M.S. Thesis
Neal Michael Hennegan Apr. 1977 62 p refs
(Contract EY-76-S-02-2383)
(COO-2383-0037; UIUCDCS-R-77-856; UILU-ENG-77-1708)
Avail: NTIS HC A04/MF A01

The need to provide a simple and efficient means for the production of interactive graphical systems led to the formulation of a hypothetical computer whose machine language is referred to as GIML. The class of interactive graphics systems for which this hypothetical machine is intended consists of those which accept input and the form of text lines and screen coordinates and employ two-dimensional pictorial representations which change in an incremental fashion. Use of the hypothetical computer is possible through the development of two programs. The first of these programs emulates the hypothetical machine and is called GIMLI for Graphical Interactive Machine Language Interpreter. The second program, GAS, is an assembler for the GIML programming language. This paper details the architecture of the hypothetical machine, outlines the GIML instruction set and assembler directives, and presents the major implementation features of the interpreter and GIML assembler. ERA

N78-13783# Illinois Univ., Urbana-Champaign. Dept. of Computer Science.
GIML REFERENCE MANUAL
N. M. Hennegan Apr. 1977 125 p
(Contract EY-76-S-02-2383)
(COO-2383-0038; UIUCDCS-R-77-857; UILU-ENG-77-1709)
Avail: NTIS HC A06/MF A01

This manual describes in detail the instruction set and assembler directives of the graphical interactive machine language GIML. The instructions are grouped according to dependence on architectural features. Included in the discussion of each instruction are the mnemonic, octal code, description, examples, and notes on assembler processing. GAS is an assembler for the GIML language which executes under the UNIX time-sharing system. The table-driven assembler features comprehensive diagnostics, efficient one-pass scanning, automatic subroutine parameter linkage, stack level monitoring, automatic generation of loads for constants, and an optional program listing. ERA

N78-13784# Stanford Univ., Calif. Digital Systems Lab.
SEQUENTIAL PREFETCH STRATEGIES FOR INSTRUCTIONS AND DATA
B. Ramakrishna Rau Jan. 1977 28 p
(Contract EY-76-C-03-0326)
(SU-326-P.39-18; SU-SEL-77-008; SU-TR-131) Avail: NTIS HC A03/MF A01

Sequential prefetch as a means of reducing the average access time was investigated. The use of a target instruction buffer is shown to enhance the performance of instruction prefetch. The concept of generalized sequentiality is developed to enable the study of sequentiality in data streams. Generalized sequentiality is shown to be present to a significant degree in data streams from measurements on representative programs. This result is utilized to develop a data prefetch mechanism which is found to be capable of anticipating, on the average, about 75 percent of all data requests. ERA

N78-13785# Stanford Univ., Calif. Digital Systems Lab.
EMMY BASED PDP-11/20 EMULATION
Charles Neuhauser Mar. 1977 41 p refs
(Contract EY-76-S-03-0326)
(SU-326-P.39-20; SU-TN-110) Avail: NTIS HC A03/MF A01

An EMM based stand-alone PDP-11/20 emulator and its support system are described. The emulator reflects nearly all user-accessible aspects of the PDP-11/20 architecture as tested by the system diagnostic routines. I/O is emulated to the extent necessary to support paper tape-based software packages, and the system has executed unmodified EDIT-11, BASIC and PAL-11A (assembler) programs. ERA

N78-13786# Stanford Univ., Calif. Digital Systems Lab.
EXACT ANALYSIS OF MODELS OF PROGRAM REFERENCE STRINGS
B. Ramakrishna Rau Dec. 1976 32 p refs
(Contract EY-76-S-03-0326-039)
(SU-326-P.39-15; SU-SEL-77-003; SU-TR-124) Avail: NTIS HC A03/MF A01

The problem of modeling program behavior is considered in the context of the study of memory systems. A suitable model is one which, at least conceptually, is capable of generating a reference string, i.e., at each instant it defines a probability distribution over the set of pages so that the next reference can be obtained by randomly sampling from the distribution. A general model of program behavior is developed based on any arbitrary events-counting measurements which might have been performed on the reference string. It is shown, based on information theoretic considerations, that the constrained maximum entropy model is the only correct one consistent with the observed measurements. Futhermore, it is shown that such a model is, in general, not amenable to exact analysis. The

conclusion is that it is unlikely that much progress will result from attempts to analyze exactly such models, which include most existing ones. Instead, more emphasis should be laid on approximate models and techniques which retain their accuracy by preserving the information that is pertinent to the analysis which is being performed. ERA

N78-13787# Argonne National Lab., Ill.
COMPARATIVE TEST RESULTS FOR TWO ODE SOLVERS: EPISODE AND GEAR
George D. Byrne (Pittsburgh Univ.), Alan C. Hindmarsh (Calif. Univ., Livermore. Lawrence Livermore Lab.), Kenneth R. Jackson (Toronto Univ., Ontario), and H. Gordon Brown (Pittsburgh Univ.) Mar. 1977 141 p refs
(Contract W-31-109-eng-38)
(ANL-77-19) Avail: NTIS HC A07/MF A01

Nonlinear systems with real and complex eigenvalues, linear systems with varied diagonal dominance, linear scalar problems, stiff and nonstiff problems, chemical kinetics with and without diurnal effect, and systems arising from the use of the numerical method of lines are discussed. Some problems are included in order to examine the options and error returns. The test results are presented in two forms: raw output and a comparative display of operation counts and of timings for the best method in the GEAR package and the best method in the EPISODE package. This approach allows a comparison of the consequences of the fixed-step interpolate strategy (GEAR) for changing step size against the truly variable step size strategy (EPISODE). It is concluded that EPISODE is generally faster than GEAR for problems involving wave fronts of transients on the interior of the interval of integration. For linear or simply decaying problems, these roles are usually reversed. ERA

N78-13788# Illinois Univ., Urbana-Champaign. Dept. of Computer Science.
UNIVERSAL LANGUAGE FOR CONTINUOUS NETWORK SIMULATION Ph.D. Thesis
T. F. Runge May 1977 160 p
(Contract EY-76-S-02-2383)
(COO-2383-0039; UIUCDCS-R-77-866; UILU-ENG-77-1717)
Avail: NTIS HC A08/MF A01

Continuous simulation modeling languages and the design and development of MODEL, a universal language for continuous network simulation are considered. The primary concern is with the language features which support the formulation of continuous system models. The area of digital continuous simulation is defined first, and a sample network that might be modeled for continuous simulation is presented. Then a survey of existing continuous simulation languages is given. After a discussion of features of the MODEL language, conclusion on the present implementation of MODEL and prospects for its further development are offered. ERA

N78-13789# Sandia Labs., Albuquerque, N. Mex.
SOFTWARE DOCUMENTATION GUIDELINES AND PROCEDURES
T. L. Bisbee and G. Carli Mar. 1977 34 p
(Contract EY-76-C-04-0789)
(SAND-77-0188) Avail: NTIS HC A03/MF A01

The requirements, responsibility, and procedures which have been established to provide security and reliability of computer coding are described. Documentation and adequate backup procedures for Division 9624-developed software are included. ERA

N78-13790# Argonne National Lab., Ill.
MATHEMATICAL SOFTWARE PRODUCTION
W. R. Cowell and L. D. Fosdick 1977 32 p refs Presented at the Symp. on Mathematical Software, Madison, Wis., 28-30 Mar. 1977
(Contract W-31-109-eng-38)
(CONF-770340-1) Avail: NTIS HC A03/MF A01

The process of producing such software begins with algorithmic analysis, and proceeds through software construction and documentation to extensive testing and, finally, to distribution and support of the software products. The technical problems that distinguish software production as an intellectual activity, problems whose descriptions also serve to characterize ideal mathematical software are examined. Next, three mathematical software projects are sketched with attention to their emphasis, accomplishments, organization, and costs. Finally, comments are offered on possible future directions for mathematical software production, as extrapolations of the present involvement of universities, government laboratories, and private industry. ERA

N78-13791# National Bureau of Standards, Washington, D. C.
USER EVALUATION OF PHASE DIAGRAMS FOR CERAMISTS AND IMPLICATIONS FOR RELATED DATA AND RESEARCH PROGRAMS
R. S. Roth, L. P. Cook, T. Negas, G. W. Cleek, and J. B. Wachtman, Jr. Aug. 1977 74 p
(PB-270973/1; NBS-SP-486; LC-77-10496) Avail: NTIS HC A04/MF A01 CSCL 11B

A survey was made of the needs of the users of 'Phase Diagrams for Ceramists,' a continuing special publication series published by the American Ceramic Society under the general editorship of the National Bureau of Standards. The results support continuation of the series, but point to needs for expanded coverage, fuller commentaries, and reduced publication time. The results also identify needs for greater effort on specific types of experimental and theoretical phase equilibria studies including the effects of variable oxygen pressure and complex metal ceramic systems. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

No abstracts in this category.

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N78-13792 Vanderbilt Univ., Nashville, Tenn.
THE SYNTHESIS OF ADAPTIVE OPTIMAL CONTROLLERS WITHOUT PROCESS MODELS Ph.D. Thesis
Jack William Morris 1977 299 p
Avail: Univ. Microfilms Order No. 77-19389

An adaptive optimal control scheme has been developed which does not impose an analytical process model in order to synthesize the optimal controller. The modelless optimal controller synthesis capability was achieved through an extension of the numerical spectral factorization technique of Knudsen and Kummel. This method has been tested experimentally on a five plate stripping column. It was found that the modelless feedforward/feedback performed as well as a modeled feedforward/feedback controller. Both optimal controllers performed markedly better than a convention PI controller. Dissert. Abstr.

N78-13793 City Univ. of New York.
DESIGN OF PROCESS CONTROLLERS Ph.D. Thesis
Zalman Joseph Palmor 1977 230 p
Avail: Univ. Microfilms Order No. 77-18892

A design method for simple sampled data control algorithms as well as an interactive design and tuning method for analog processes controllers are presented. The real goals of a design and the requirements of a sampled data process controller algorithm are stated. The control problems associated with relatively infrequent samplings are discussed and treated. The results derived for sampled data controllers are extended to continuous control. An interactive tuning procedure for analog controllers for processes with relatively large dead times is suggested. The method is based on sensitivity analysis and a modified version of the mini-max procedure. The special stability problems associated with dead time compensation and inversion of transfer function are pointed out. Dissert. Abstr.

N78-13794# Westinghouse Defense and Electronic Systems Center, Baltimore, Md.
A DISCUSSION OF HARDWARE IMPLEMENTATION AND FABRICATION FOR AN AUTOMATIC TARGET CUEING SYSTEM
Thomas Willett and Nathan Bluzer Computer Science Center 30 Apr. 1977 46 p Prepared in cooperation with Maryland Univ. Baltimore, Md.
(Contract DAAG53-76-C-0138)
(AD-A045335; QSR-4) Avail: NTIS HC A03/MF A01 CSCL 19/5

Hardware implementation and fabrication of algorithms developed for the focal plane is described along with embodiment of image segmentation, feature extraction, and classification in CCD technology. J.M.S.

N78-13795# Colorado Univ., Boulder. Dept. of Electrical Engineering.
A SYNTHESIS THEORY FOR MULTIPLE-LOOP OSCILLATING ADAPTIVE SYSTEMS Interim Report
Isaac Horowitz (Weizman Inst. of Sci., Rehovot, Israel) and Aharon Shapiro 1977 39 p refs
(Grant AF-AFOSR-2946-76)
(AD-A045827; AFOSR-77-1221TR) Avail: NTIS MF A01 CSCL 09/4

The multiple-loop self-oscillating adaptive (SOAL) system is presented as a natural, logical means of overcoming a serious limitation of the single-loop self-oscillating system (SOAS). Both structures have the property of zero sensitivity to plant high-frequency gain uncertainty Rho k sub max/k sub min, the factor which is generally responsible for large 'cost of feedback'. It is however necessary to design these systems such that the response is essentially quasilinear to the desired class of command and disturbance signals. In the SOAS, Rho reappears as a significant factor in the quasilinear requirements which may, depending on the numbers involved, completely vitiate its banishment as an uncertainty factor. The development of a quantitative design theory for the SOAS pinpoints the two-loop SOAL extension needed to overcome this SOAS limitation, and the development of a similar SOAL quantitative design theory. In the latter, Rho disappears from both the adaptive and quasilinear conditions, but reappears as a factor in the rate of adaptation of the system. It may be banished from here too, by means of a three-loop self-oscillating system (SOANL), for which the SOAL design theory is applicable with minor extensions. GRA

N78-13796# Stanford Univ., Calif. Dept. of Computer Science.
VERIFICATION VISION WITHIN A PROGRAMMABLE ASSEMBLY SYSTEM Ph.D. Thesis
Robert C. Bolles Dec. 1976 246 p refs
(Contract MDA903-76-C-0206; ARPA Order 2494)
(AD-A045723; STAN-CS-77-591) Avail: NTIS HC A11/MF A01 CSCL 13/8

The research reported in this thesis concentrates on a subclass of visual information processing referred to as verification vision (abbreviated VV). VV uses a model of a scene to locate objects of interest in a picture of the scene. The characteristics that distinguish VV from the other types of visual information processing are: (1) the system has a great deal of prior knowledge about the type, placement, and appearance of the objects that form the scene, and (2) the goal is to verify and refine the location of one or more objects in the scene. VV includes a significant portion of the visual feedback tasks required within programmable assembly. For example, locating a screw hole and determining the relative displacement between a screw hole are both VV tasks. There are several types of information available in VV tasks that can facilitiate the solution of such tasks: a model of each object in the scene, a set of initial constraints on the locations of the objects, and a set of previous pictures of this scene or similar scenes. Additional information can be obtained by applying visual operators to a current picture of the scene. GRA

N78-13797# Maryland Univ., College Park. Computer Science Center.
A SURVEY OF RANDOM PATTERN GENERATION PROCESSES
Bruce Schachter and Narendra Ahuja Jul. 1977 42 p refs
(Contract AF-AFOSR-3271-77)
(AD-A045867; AFOSR-77-1225TR; CSC-TR-549) Avail: NTIS HC A03/MF A01 CSCL 14/5

Random pattern generation processes can provide a rich class of models for both the synthesis and analysis of visual textures. This report describes a variety of such processes including point processes, random mosaic processes, and bombing processes. Standard texture analysis approaches (e. g., cooccurrence matrices) are related to texture models based on these random processes. Examples to several textures synthesized by computer in accordance with these models are presented. Author (GRA)

N78-13798# Oxford Univ. (England). Engineering Lab.
COMPARISONS OF ADAPTIVE CONTROLLERS, PART 1
O. Jacobs and P. Saratchandran 1977 37 p refs Sponsored by Sci. Res. Council
(OUEL-1202/77) Avail: NTIS HC A03/MF A01

Adaptive control of discrete time-processes satisfying first-order linear difference equations with random coefficients which may be constant or time-varying is discussed. Fundamental questions considered are: when is adaptive control necessary? difficult? impossible? Sub-optimal adaptive controllers are compared and some results of systematic Monte Carlo simulations are reported. The simulations show that optimal k-step-ahead control can be appreciably better than, and is never worse than, self-tuning control; they also show how answers to the fundamental questions can depend on stability of the controlled process. Processes having gain of uncertain sign, or a non-zero desired value of output, are not discussed. Author (ESA)

N78-13799# Oxford Univ. (England). Engineering Lab.
MINIMAX ADAPTIVE CONTROL
O. Jacobs and J. R. Colville 1977 22 p refs
(OUEL-1203/77) Avail: NTIS HC A02/MF A01

A new, exact, on line, estimation algorithm based on a set-membership description of uncertainty is described. The estimation is combined with a minimax control law to form an adaptive controller which is shown to compare favorably with conventional adaptive control laws. ESA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N78-13800 California Univ., Berkeley
MAXIMUM PRINCIPLES, GRADIENT ESTIMATES, AND WEAK SOLUTIONS FOR PARTIAL DIFFERENTIAL EQUATIONS OF ELLIPTIC AND PARABOLIC TYPE Ph.D. Thesis
William Israel Bertiger 1976 26 p
Avail: Univ. Microfilms Order No. 77-15608

Weak solutions to elliptic equations are discussed and theorems concerning L superscript P bounds on solutions and their derivatives are proved. Classical solutions of equations with nonnegative characteristic form are considered. The main theorem pertaining to these solutions concerns maximum principles for derivatives of solutions. Dissert. Abstr.

N78-13801 Rutgers - The State Univ., New Brunswick, N. J.
SOLVABLE EXTENSIONS FOR LINEAR AND NONLINEAR OPERATORS, THE NATURE OF THEIR DOMAINS, AND ERROR ANALYSIS FOR APPROXIMATE SOLUTIONS AND RESIDUALS Ph.D. Thesis
Edward John Conjura 1977 176 p
Avail: Univ. Microfilms Order No. 77-17525

Solvable extensions are given for densely defined operators of K-positive definite type and error estimates are computed for approximate solutions and residuals. Dissert. Abstr.

N78-13802 Johns Hopkins Univ., Baltimore, Md.
BIRKHOFF-PFAFFIAN SYSTEMS Ph.D. Thesis
Edwin Garfield Clawsey 1977 57 p
Avail: Univ. Microfilms Order No. 77-19583

A system of ordinary differential equations which admits a

relatively invariant line integral is known as a Birkhoff-Pfaffian system when it is of even order and the coefficient matrix is required to satisfy a mild condition of invertibility. It can, by virtue of a change of variables, be written in canonical form. This fact led to the conjecture that the principal mathematical properties of Hamiltonian systems do not depend on the p-q dichotomy of the variables. This work was a generalization of the Jacobi method and the theorems of Liouville and Lie from canonical systems to the more general Birkhoff-Pfaffian systems. Dissert. Abstr.

N78-13803 Houston Univ., Tex.
ROTATIONALLY INVARIANT KERNEL SYSTEMS OF ANALYTIC FUNCTIONS ON THE UNIT DISK Ph.D. Thesis
Thomas Burrows Dennis 1977 37 p
Avail: Univ. Microfilms Order No. 77-19568

The Kernel systems (K sub alpha, U, H sub alpha, Q sub alpha) relatively to a complete inner product space (Y, less than . . . greater than) are studied, which have the property that K sub alpha(s,t) is alpha(st*) for some operator valued analytical function alpha on the unit disk U. The connecting link between the set U, the Hilbert space (H sub alpha, Q sub alpha) of functions from U to Y, and the Kernel K sub alpha in such a system is outlined. Characterizations are given of the analytic functions alpha which determine the kernels, the spaces H sub alpha, and the inner products Q sub alpha. Next, there is a characterization of the systems which possess this type of kernel. Dissert. Abstr.

N78-13804 Michigan Univ., Ann Arbor.
COMPLEX ERROR ANALYSIS AND THE FAST FOURIER TRANSFORM Ph.D. Thesis
Leonard Joseph Harding, Jr. 1977 160 p
Avail: Univ. Microfilms Order No. 77-18022

Several implementations of the FFT algorithm, using the criteria of accuracy and efficiency, are examined. The a priori error analyses of these implementations are based on the precise sequence of floating point operations, either real or complex, which are performed; particular attention is accorded to the auxiliary computations associated with the complex exponentials. These analyses of the FFT algorithm are pursued from the point-of-view of the software designer. The objective is to obtain an accurate, but efficient, implementation of the FFT algorithm for the floating-point systems considered. Dissert. Abstr.

N78-13805 Michigan State Univ., East Lansing.
NUMERICAL METHODS IN MULTIPLE INTEGRATION Ph.D. Thesis
Wayne Eugene Hoover 1977 178 p
Avail: Univ. Microfilms Order No. 77-18491

Since very little is known concerning formulas which make use of partial derivative data, the objective is to construct formulas involving not only the traditional weighted sum of function values, but also partial derivative correction terms with weights of equal magnitude and alternate signs at the corners or at the midpoints of the sides of the domain of integration. For a single integral, the derivative correction terms were evaluated only at the end points of the interval of integration. In higher dimensions, the situation was somewhat more complicated since as the dimension increased the boundary became more complex. Indeed, in higher dimensions, most of the volume of the n-rectangle laid near the boundary. This was accounted for by the construction of multidimensional integration formulas with boundary partial derivative correction terms, the number of which increases as the dimension increases. Dissert. Abstr.

N78-13806 State Univ. of New York, Stony Brook.
ON THE INVERSE PROBLEM BY MEANS OF THE INTEGRAL EQUATION OF THE FIRST KIND Ph.D. Thesis
Emmanuel M. Tsimis 1977 291 p
Avail: Univ. Microfilms Order No. 77-20029

A discussion on the inverse problem and the integral equation of the first kind is presented. A derivation of the additive functional of the Phillips-Tihonov regularization method is included, and a regularization method based on a theorem by C. Caratheodory is proposed. The concept of weak solutions of the integral equation of the first kind is introduced, and a theory is developed upon it. The optimum choice of the points of discretization is dealt with for the numerical solution of the integral equation of the first kind, with kernel from certain categories: (1) strictly totally positive; (2) continuous in the variable of integration and differentiable in the other with derivative of bounded-variation; (3) of Volterra type. Complements to the Phillips-Tihonov regularization method are considered also. Dissert. Abstr.

N78-13807# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
AN ALGORITHM FOR A HYPERBOLIC FREE BOUNDARY PROBLEM
J. C. W. Rogers May 1977 90 p refs
(Contract N00017-72-C-4401)
(AD-A045512; APL/JHU/TG-1309) Avail: NTIS HC A05/MF A01 CSCL 20/4

In this report, which is the first part of a more comprehensive work, a solution algorithm is given for a hyperbolic conservation law. The algorithm is of an embedding type in that the solution is built up from Green's functions for simple processes taking place without reference to boundaries, and the locations of shocks are not explicitly followed. There is a discussion of boundary conditions and treatment of the Burgers and Korteweg-de Vries equations. Cursory mention is made of the extension to systems. Appropriate function spaces for solutions are introduced. The effects of perturbations in the initial conditions and of the velocity of propagation of disturbances are analyzed. For a monotonic velocity profile, in the one-dimensional case without boundaries, a convergence proof and error estimate are given. GRA

N78-13808# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
SOLVING LARGE ZERO-ONE KNAPSACK PROBLEMS
Egon Balas and Eitan Zemel Jul. 1977 36 p refs Revised
(Contract N00014-75-C-0621; Grant NSF MPS-73-08534)
(AD-A045529; RR-408) Avail: NTIS HC A03/MF A01 CSCL 12/1

An algorithm for the 0-1 knapsack problem (KP) is described which relies mainly on three new ideas. The first one is to focus on the core of the problem, namely a knapsack problem equivalent to (KP), defined on a particular subset of the variables. The size of this core is usually a small fraction of the full problem size, and does not seem to increase with the latter. While the core cannot be identified without solving (KP), a satisfactory approximation can be found by solving (LKP), the associated linear program. The second new ingredient is a binary-search-type procedure for solving (LKP) which, unlike earlier methods, does not require any ordering of the variables. Finally, the third new feature is a simple-minded heuristic whose accuracy under certain conditions grows exponentially with the problem size. Computational experience with an algorithm based on the above ideas, on 200 randomly generated test problems with 1,000-10,000 variables and with coefficients ranging from between 10-100 to be between 10-10,000, indicates that for such problems the computational effort grows linearly with the number of variables and logarithmically with the range of coefficients. Total time for the 200 problems was 160 UNIVAC 1108 seconds, and the maximum time for any single problem was 3 seconds. GRA

N78-13809# California Univ., Los Angeles.
BIHARMONIC AND POTENTIAL FUNCTIONS AND THEIR APPLICATIONS Final Report, 1 Oct. 1970 - 15 Aug. 1977
Leo Sario Sep. 1977 9 p
(Grant DA-ARO(D)-31-124-71-G20;
DA-ARO(D)-31-124-71-G181)
(AD-A045729; ARO-9653.93-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

The following theories were systematically developed: (1) Harmonic classification theory of Riemannian manifolds, (2) Quasiharmonic classification theory of Riemannian manifolds, (3) Theory of bounded biharmonic functions of Riemannian manifolds, (4) Dirichlet finite biharmonic functions, (5) Bounded Dirichlet finite biharmonic functions, (6) Riesz representation of biharmonic functions, (7) Green's functions of simply supported bodies, (8) Green's functions of clamped bodies. These theories were published in the 83 papers listed in Sections II-IV, and the research monograph described in Section V. Author (GRA)

N78-13810# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.

THE USE OF HARMONIC ANALYSIS IN SUBOPTIMAL ESTIMATOR DESIGN Interim Report

Steven I. Marcus (Texas Univ., Austin), Alan S. Willsky, and Kai Hsu (Texas Univ., Austin) Sep. 1977 30 p refs

(Grants AF-AFOSR-2273-72; NSF GK-42090; AF Proj. 2304) (AD-A045842; AFOSR-77-1250TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The state estimation problem for bilinear stochastic systems evolving on compact Lie groups and homogeneous spaces is considered. The problem is motivated by some applications involving rotational processes in three dimensions. The theory of harmonic analysis on compact Lie groups is used to define assumed density approximations which result in implementable suboptimal estimators for the state of the bilinear system. The results of Monte Carlo simulations are reported; these indicate that simple filters designed by these techniques perform well as compared to other filters. Author (GRA)

N78-13811# Stanford Univ., Calif. Dept. of Computer Science.

NUMERICAL SOLUTION OF NONLINEAR ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS BY A GENERALIZED CONJUGATE GRADIENT METHOD

Paul Concus (Calif. Univ., Livermore. Lawrence Livermore Lab.), Gene H. Golub, and Dianne P. OLeary (Mich. Univ., Ann Arbor) Dec. 1976 46 p refs

(Contract EY-76-S-03-0326; Grant NSF MCS-75-13497-A01) (SU-326-P.30-50; SU-STAN-CS-76-585; LBL-5572) Avail: NTIS HC A03/MF A01

Extensions were made to a generalized conjugate gradient method for solving sparse positive-definite systems of nonlinear equations arising from the discretization of elliptic partial differential boundary value problems. The discretized operator was split into the sum of two operators, one of which corresponded to a more easily solvable system of equations, and the associated iteration based on this splitting by conjugate gradients was accelerated. The behavior of the method is illustrated for the minimal surface equation with splittings corresponding to nonlinear SSOR, to approximate factorization of the Jacobian matrix, and to elliptic operators suitable for use with fast direct methods. The results of numerical experiments are given as well for a mildly nonlinear example, for which, in the corresponding linear case, the finite termination property of the conjugate gradient algorithm is crucial. ERA

N78-13812# Stanford Univ., Calif. Digital Systems Lab.

SOME NOTES ON THE LOG CONJECTURE FOR PARALLEL PROCESSORS

Philip Yu Jun. 1976 25 p refs

(Contract EY-76-S-03-0326-039)

(SU-326-P.39-10; SU-TN-90) Avail: NTIS HC A02/MF A01

Different approaches are tried to justify Minsky's conjecture. In the first approach, two different methods are used to model the effects of conditional branching. The lack of general information on program behavior makes it difficult to derive any general result. Minsky's conjecture is derived under certain assumptions. Since the program behavior under some of the assumptions is inclined to keep more processors active, this gives a gloomy perspective to array processor organization. The second approach, evading the problem of program behavior, tries to evaluate the space-time product from computational complexity. This approach is far too general and fails to provide any significant result. ERA

N78-13813# Maryland Univ., College Park. Inst. for Physical Science and Technology.

UNIQUENESS OF FRANKYL-MORAWETZ PROBLEM IN R3

A. K. Aziz and M. Schneider (Tech. Univ., Berlin, West Ger.) Mar. 1977 23 p refs

(Contract EY-76-S-05-3443)

(ORO-3443-64; BN-851) Avail: NTIS HC A02/MF A01

A variation of the a,b,c method is to obtain sufficient conditions for the uniqueness of the solution of certain boundary-value problems. The technique of how to use the method in R cubed for a general linear equation of second order is developed. Several gaps in published work are corrected. ERA

N78-13814# Los Alamos Scientific Lab., N. Mex.

VECTORIZATION FOR THE CRAY-1 OF SOME METHODS FOR SOLVING ELLIPTIC DIFFERENCE EQUATIONS

B. L. Buzbee, G. H. Golub, and J. A. Howell 1977 18 p refs Presented at Symp. on High Speed Computer and Algorithm Organ. Urbana, Ill., 13-15 Apr. 1977

(Contract W-7405-eng-36)

(LA-UR-77-1231; Conf-770413-2) Avail: NTIS HC A02/MF A01

Efficient implementation on the CRAY-1 of some familiar techniques for solving elliptic difference equations is discussed. CRAY-1 architectural features that are important when seeking to achieve optimum performance of the machine are summarized, and accommodation of these in the implementation of point relaxation is explained. The discussion includes complications to vectorization caused by irregular regions. Finally, quantitative measurements of algorithmic performance on the CRAY-1 are provided. ERA

N78-13815# Maryland Univ., College Park. Inst. for Physical Science and Technology.

STUDIES OF THE NUMERICAL SOLUTION OF ELLIPTIC PARABOLIC BOUNDARY VALUE PROBLEMS Progress Report, 1 Nov. 1976 - 31 Oct. 1977

I. Babuska 1977 9 p refs

(Contract EY-76-S-05-3443)

(ORO-3443-65) Avail: NTIS HC A02/MF A01

Problems in the use of the finite element method in technical practice were examined and were studied. Considerable effort was devoted to numerical solution of boundary value problems of mixed type. Approaches considered were reduction of the second order boundary value problem to an equivalent boundary value problem for a first order system and direct finite element formulation of the second order problem. The other area of concentration was problems concerning differential equations with rapidly changing coefficients. Finding an approximate replacement for such an equation by an 'averaged' equation was studied. ERA

N78-13816# Maryland Univ., College Park. Inst. for Physical Science and Technology.

NUMERICAL TREATMENT OF EIGENVALUE PROBLEMS FOR DIFFERENTIAL EQUATIONS WITH DISCONTINUOUS COEFFICIENTS

I. Babuska and J. E. Osborn Apr. 1977 119 p refs

(Contract EY-76-S-05-3443)

(ORO-3443-63; BN-853) Avail: NTIS HC A06/MF A01

The eigenvalues of a second-order differential equation are approximated by factoring the second order equations into a first order system and then applying the Ritz-Galerkin method to this system. Convergence results and error estimates are devised. These error estimates are based on the application of Sobolev spaces with variable order. ERA

N78-13817# Texas Univ., Austin. Texas Inst. for Computational Mechanics.

MIXED-HYBRID FINITE ELEMENT APPROXIMATIONS OF SECOND-ORDER ELLIPTIC BOUNDARY-VALUE PROBLEMS. 2: WEAK-HYBRID METHODS

I. Babuska, J. T. Oden, and J. K. Lee May 1977 49 p refs

(Contract EY-76-S-05-3443)

(ORO-3443-66) Avail: NTIS HC A03/MF A01

A new class of hybrid finite element methods for the numerical analysis of second-order elliptic boundary-value problems is presented. The methods are characterized by the use of particular solutions of the differential equation being solved, in contrast to conventional hybrid methods, in which polynomial approximations are used. As a model problem the Dirichlet problem for Laplace's equation is studied. A priori error estimates are derived, and the results of numerical experiments are presented. ERA

N78-13818# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.

SOME HYPERMATRIX ALGORITHMS IN LINEAR ALGEBRA

K. A. Braun, G. Dietrich, G. Frik, T. L. Johnsen, K. Straub, and G. Vallianos May 1977 49 p refs Repr. from 'Lecture Notes in Econ. and Math. Systems', vol. 134, Springer Verlag, Berlin, 1976 Presented at the 2d Intern. Symp. on Computing Methods in Appl. Sci. and Eng., Versailles, France, 15-19 Dec. 1975
(ISD-220) Avail: NTIS HC A03/MF A01

The hypermatrix storage scheme is briefly discussed and the most important hypermatrix algorithms are surveyed. The well established hypermatrix algorithms dealt with are addition, multiplication, Cholesky decomposition, forward and backward substitution, and Jacobi algorithm for a Hermitean matrix. Other topics are the QR-decomposition of the natural factor and the hypermatrix formulation of the Eberlein method. ESA

N78-13819# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
THE INCORPORATION OF BOUNDARY CONDITIONS IN SPLINE APPROXIMATION PROBLEMS
M. G. Cox Jun. 1977 22 p refs Presented at the Bien. Conf. on Numerical Anal., Dundee, Scot., Jun.-Jul. 1977
(NPL-NAC-80) Avail: NTIS HC A02/MF A01

The problem of determining polynomial spline approximations subject to derivative boundary conditions was considered. It is shown that if B-splines are employed as a basis, the incorporation of a variety of boundary conditions and the solution of the resulting equations for the B-spline coefficients can be carried out in an efficient and stable manner. The methods discussed can be applied to interpolating splines and to splines which approximate discrete data sets in the least squares sense. The boundary conditions can normally be incorporated by extending and refining existing algorithms rather than by designing entirely new ones. Author (ESA)

N78-13820# Montpellier Univ. (France). Dept. de Physique Mathematique.
ON THE SOLUTIONS OF AN INFINITE SYSTEM OF NON-LINEAR EQUATIONS
P. C. Sabatier 1977 8 p refs Presented at the NATO Summer-School on Non-Linear Equations in Phys. and Math., Istanbul, 1977
(PM/77/10) Avail: NTIS HC A02/MF A01

A conjecture by Calogero that a specific infinite system of nonlinear equations has a real solution which is unique up to some trivial transformations is proved. ESA

N78-13821# Montpellier Univ. (France). Dept. de Physique Mathematique.
INVERSE SCATTERING PROBLEMS FOR NON-LINEAR APPLICATIONS
P. C. Sabatier 1977 25 p refs Presented at the NATO Summer-School on Non-Linear Equations in Phys. and Math., Istanbul, 1977
(PM/77/11) Avail: NTIS HC A02/MF A01

A unified review of the methods of solution of inverse scattering problems in regard to their application to nonlinear evolution equations is performed. ESA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N78-13822 Houston Univ., Tex.
DOUBLY STOCHASTIC APPROXIMATIONS OF REAL SQUARE MATRICES Ph.D. Thesis
Eva Achilles 1977 71 p
Avail: Univ. Microfilms Order No. 77-19567

Doubly stochastic and generalized doubly stochastic matrices with prescribed zero patterns and the minimum Euclidean distance to a given real matrix are investigated. Their properties regarding the behavior of the permanent function and the sums of diagonals are established. A formula is given for a generalized doubly stochastic matrix which is the projection of a real matrix, and matrices having the same projections are studied. A recursive process is developed which provides the doubly stochastic matrix closest to a given real matrix. Dissert. Abstr.

N78-13823 Washington Univ., Seattle.
ROBUST ESTIMATION OF LOCATION AND SCALE VIA STOCHASTIC APPROXIMATION Ph.D. Thesis
Daniel Merlyn Goodfellow 1977 226 p
Avail: Univ. Microfilms Order No. 77-18351

For the problem of robust estimation of location most of the research to date has focused on one of the following classes of estimates: L-estimates, M-estimates, and R-estimates. Some work has appeared in the literature dealing with stochastic approximation type estimates, or SA-estimates. The latter are appealing for many applications because they involve sequential processing of the data. Two problems associated with SA-estimates were examined. The first is that of simultaneously estimating location and scale parameters robustly from an asymptotic point of view. The second is concerned with determining the small sample robustness properties of various SA-estimates via highly precise Monte Carlo studies based on Monte Carlo swindle techniques. Dissert. Abstr.

N78-13824# Maryland Univ., College Park. Computer Science Center.
STATISTICAL PROPERTIES OF THRESHOLDED IMAGES
Durga P. Panda Jul. 1977 44 p refs
(Contract DAAG53-76-C-0138; ARPA Order 3206)
(AD-A045336; TR-559) Avail: NTIS HC A03/MF A01 CSCL 14/5

The threshold operator is an important operator in image analysis tasks such as segmentation and edge detection. A statistical analysis of the response of this operator is presented in this paper. The input grayscale image is modelled as a two-dimensional homogeneous random process completely characterized by its mean and power spectrum. Author (GRA)

N78-13825# Maryland Univ., College Park. Computer Science Center.
STATISTICAL ANALYSIS OF SOME EDGE OPERATORS
Durga P. Panda Jul. 1977 61 p refs
(Contract DAAG53-76-C-0138)
(AD-A045337; TR-558) Avail: NTIS HC A04/MF A01 CSCL 14/5

A statistical analysis of the responses of some linear and nonlinear edge operators is presented. The input image is treated as a stationary random field from a context independent ensemble. Several stochastic properties of the output images are predicted. Some experimental results are given. Author (GRA)

N78-13826# Temple Univ., Philadelphia, Pa. Dept. of Mathematics.
ON MEASURES OF DEPENDENCE. A SURVEY OF RECENT DEVELOPMENTS, REVISION
S. Kotz Jul. 1977 53 p refs Supersedes AD-A041814
(Grant AF-AFOSR-2837-75)
(AD-A045166; AFOSR-77-0745TR-Rev) Avail: NTIS HC A04/MF A01 CSCL 12/1

The purpose of these notes is to survey the recent literature on dependence between two random variables and to stimulate research which will extend (some of) these concepts and relations to the case of 3 or more variables. Author (GRA)

N78-13827# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Statistics.
A NEW APPROACH TO THE ANLAYSIS OF STOCHASTIC LANCHESTER PROCESSES. I. TIME EVOLUTION
Peter P. Perla and John P. Lehoczky Sep. 1977 37 p refs
(Contract N00014-77-C-0161)
(AD-A045176; TR-135) Avail: NTIS HC A03/MF A01 CSCL 12/2

A new approach to the study of stochastic Lanchester processes based on diffusion approximations is presented. The distribution of the two force levels over time is shown to be well approximated by a nonstationary bivariate Gaussian diffusion process with specified mean and covariance structure. The approximation is based on an asymptotic analysis which assumes the initial force levels are large. Numerical studies are presented, however, which show surprising accuracy for force levels as small as 30. A wide variety of attrition structures are discussed including the linear and square law cases, Helmbold's general attrition structure, Karr's engagement model, and heterogeneous

models. The development of tractable mathematical expressions for the time evolution of complicated Lanchester-type attrition processes makes possible the introduction and analysis of decision theoretic aspects to the problem such as force level decisions, combat tactics, reinforcement decisions, and the value of information about the opponent's strengths, weaknesses, and strategies. Author (GRA)

N78-13828# Naval Postgraduate School, Monterey, Calif.
MODELING AND RECURSIVE ESTIMATION OF TWO DIMENSIONAL RANDOM FIELDS AND APPLICATIONS TO TARGET DETECTION
Moshe Shachar Jun. 1977 216 p refs
(AD-A045179) Avail: NTIS HC A10/MF A01 CSCL 12/1

First an investigation of modeling stochastic processes by difference equations (Markov process) was undertaken. The starting point of the modeling procedure is the knowledge of the spectrum of the process. Two methods are discussed. One is based on optimal estimation theory and leads in most cases to a high-order (perhaps infinite) Markov process. The second method, based on linear system theory, leads to a first order Markov process (in matrix representation). Both methods have been extended to two-dimensional processes. Secondly, recursive estimation (filtering) of two-dimensional random fields was addressed. It was shown that a two-dimensional recursive filter cannot be optimal. Therefore, only a sub-optimal solution is available. This solution minimizes the mean square error for a specific structure of a filter. Finally, applications of modeling and recursive filtering are discussed. An image that includes a target, correlated noise and random noise was processed. Some methods of target enhancement (also called 'restoration' are discussed. Author (GRA)

N78-13829# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Statistics.
A DIFFUSION APPROXIMATION ANALYSIS OF A GENERAL n-COMPARTMENT SYSTEM Interim Report
John P. Lehoczky and Donald P. Gaver May 1977 42 p refs
(Grant AF-AFOSR-2642-74; NSF AG-467; AF Proj. 2304)
(AD-A045411; TR-110; AFOSR-76-1058TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

A new approach to the stochastic analysis of general compartment models is presented. The analysis is based on the concept of diffusion approximations. The state of a compartment system is represented as the superposition of a deterministic process, characterized by a system of ordinary differential equations, and a random noise process characterized by stochastic differential equations. All transition rate parameters are permitted to be time dependent. Numerical solutions are presented for the two-compartment case, and compared with those of Cardenas and Mates (1975a). Extensions to non-linear compartment models are discussed. Author (GRA)

N78-13830# Oxford Univ. (England). Engineering Lab.
STOCHASTIC DIFFERENTIAL EQUATIONS: THEIR THEORY AND APPLICATIONS
C. J. Harris 1977 44 p refs
(OUEL-1204/77) Avail: NTIS HC A03/MF A01

An important step in the modeling of dynamic systems is in the validation of the model equations with experimental data or observations. If the model is described by either nonlinear or partial differential equations, analytical or closed form solutions are in general extremely complex to find and recourse is made to either simulation or numerical approximation techniques. Some inadequacy of the modeling process due either to lack of physical insight or to representation of distributed parameter systems by lumped parameter models, can be conveniently represented by introducing random perturbations in either the model inputs or in model parameters. The resulting equations are nonlinear stochastic differential/integral equations, which are suitable for describing a wide variety of complex engineering, econometric, and biological systems. An introduction into the theory of stochastic differential equations is given together with two case studies. Author (ESA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N78-13831 Purdue Univ., Lafayette, Ind.
MEASUREMENT AND RECONSTRUCTION OF ULTRASONIC PARAMETERS FOR DIAGNOSTIC IMAGING Ph.D. Thesis
Kris Allen Dines 1976 259 p
Avail: Univ. Microfilms Order No. 77-15400

Techniques in linear system analysis, digital signal processing, and picture reconstruction are investigated and applied to diagnostic ultrasound imaging. These investigations include system modeling and attenuation measurement for tissue characterization, digital reconstruction of spatial distributions of ultrasound attenuation and velocity in tissue, and reconstruction using a fan-beam scanning geometry. Dissert. Abstr.

N78-13832 Case Western Reserve Univ., Cleveland, Ohio.
A QUEUEING PROCESS IN WHICH TWO REPAIRMEN SERVICE SEVERAL MACHINES Ph.D. Thesis
Sara Marta Debanne 1977 83 p
Avail: Univ. Microfilms Order No. 77-18817

Consider a system of n machines running independently of each other and serviced by two repairmen in the same order in which breakdowns occur. If consecutive running times are exponentially distributed and service times have the gamma distribution of order two, then, by starting with the underlying Markov process, recursive techniques are used to find the limiting distribution for the total number of machines broken. Next, a method of Kopocinska is used to give this limiting distribution in terms of the stationary distribution of the imbedded Markov chain: the latter being much easier to calculate from available data in real life situations. Next, a system of m machines serviced by one repairman is analyzed by a method of Takacs to yield the limiting distribution of the number of machines broken and the stationary distribution of the imbedded Markov chain. Dissert. Abstr.

N78-13833 Rice Univ., Houston, Tex.
ON VALUE THEORIES FOR N-PERSON COOPERATIVE GAMES Ph.D. Thesis
Gabriel Turbay 1977 173 p
Avail: Univ. Microfilms Order No. 77-19295

A technique for game theoretical analysis was introduced under the name of 'utility transfer analysis'. The technique, based on the so called theorems of the alternatives, and also on an extension of the concept of balanced sets allows the characterization of sets of coalitions in a state of relative equilibrium with respect to payoff distributions. A theory of solutions based on the utility transfer analysis technique was developed, and all the computational and theoretical power of linear programming was made available when the solutions of the game were equivalently defined by means of associated linear programming problems. A value theory for n-person games was built using the above mentioned theory of solutions and a one-point solution was defined. Dissert. Abstr.

N78-13834# Naval Postgraduate School, Monterey, Calif.
ROBUST REGRESSION USING MAXIMUM-LIKELIHOOD WEIGHTING AND ASSUMING CAUCHY-DISTRIBUTED RANDOM ERROR M.S. Thesis
Harry Richard Moore, II Jun. 1977 60 p refs
(AD-A045132) Avail: NTIS HC A04/MF A01 CSCL 12/2

Least-squares estimates of regression coefficients are extremely sensitive to large errors in even a single data point. Frequently, an ad-hoc procedure is used to weight the data in a manner to alleviate the effects of extreme observations. This thesis is a study of the effectiveness of an iterative regression method using weights derived through maximum-likelihood arguments. Actual weights are calculated on the assumption of Cauchy-distributed error as a worst-case situation in which the errors have long, fat tails and no finite moments. Author (GRA)

N78-13835# George Washington Univ., Washington, D. C.
SOME PRACTICAL CONSIDERATIONS IN THE APPLICATION OF FINITE SOURCE QUEUEING MODELS

Zeev Barzily, Donald Gross, and Henry D. Kahn 26 Sep. 1977 34 p refs
(Contract N00014-75-C-0729)
(AD-A045816; Serial-T-360) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper considers some practical aspects of an application of finite source (machine repair) queueing models. Exact models for small calling populations are developed to investigate (a) transient effects; (b) the effect of assuming population items operate continuously, when, in fact, they may be idle a portion of the time; and (c) the effect of having population items with unequal failure rates, but assuming all items fail at the population average values. Implications from the small population models and from models which bound and approximate larger population sizes are discussed. GRA

N78-13836# General Electric Co., Syracuse, N.Y. Heavy Military Equipment Div.
ANALYSIS OF A MULTI-SERVER, FINITE LENGTH QUEUE WITH FEEDBACK
G. Arabadjis Sep. 1977 34 p refs
(AD-A045457; R77EMH9) Avail: NTIS HC A03/MF A01 CSCL 09/2

This memo contains a performance analysis of a queueing model that arose in conjunction with a multi-microprocessor system with queue memories. The model consists of s-parallel processors fed by a common queue. Arriving tasks enter service immediately if a processor is available, or join a queue to wait for a processor, or become lost if the finite capacity queue is full. A completed task may leave the system or, with some probability, spawn another task which then goes to the end of the queue. The arrival stream is assumed Poisson and the service times are exponentially distributed. This memo also contains curves of mean waiting time, fraction of lost tasks, fraction of time system is busy and mean busy period versus traffic intensity.
Author (GRA)

N78-13837# Argonne National Lab., Ill.
TSO AT AMD: THE APPLIED MATHEMATICS DIVISION'S IMPLEMENTATION OF THE TIME SHARING OPTION
Alan J. Burger 26 May 1975 152 p
(Contract W-31-109-eng-38)
(ANL-AMD-TM-262) Avail: NTIS HC A08/MF A01

The Time-Sharing Option (TSO) as implemented on the IBM 360/75 is described. Specific topics discussed include: (1) the TSO Command Processors available at AMD; (2) the local modifications to TSO Command Processors; (3) how the functions performed by these commands can be accomplished; and (4) the TSO Command Procedures automatically available to those users logged on under the default logon procedure. ERA

N78-13838# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
THE APPLICATION OF THE HILBERT TRANSFORM TO SYSTEM RESPONSE ANALYSIS
C. W. Skingle, K. H. Heron, and D. R. Gaukroger London Aeron. Res. Council 1977 22 p refs Supersedes RAE-TR-74117; ARC-35681
(ARC-CP-1378; RAE-TR-74117; ARC-35681) Avail: NTIS HC A02/MF A01; HMSO£1.50; PHI $5.80

The application of the Hilbert transform to the analysis of the response of linear multi-degree-of-freedom systems to random forces is considered. The use of this transform in deriving modal properties of a system from the spectral density of the response of the system to a random input force which has a flat spectrum is demonstrated. It is also shown that the Fourier transform of the one-sided autocorrelogram of the response implicity involves a Hilbert transform. The Hilbert transform can be realized, in practice, by simple manipulation of signals in the time domain, and by Fourier transform processes available in commercial Fourier analyzers. Author (ESA)

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N78-13839 California Univ., Berkeley.
ADMISSIBLE SETS AND THE SATURATION OF STRUCTURES Ph.D. Thesis
Alan Aage Adamson 1976 123 p
Avail: Univ. Microfilms Order No. 77-15582

Attempts are made to fill a gap left by Ressayre in some work on model theory. He showed that if K epsilon A and M is a countable A-saturated K-structure, then some isomorph of M is contained in a fattening of A. Ressayre gave proof only for the converse for A of the form L sub alpha (X). This 'missing' full converse is the gap mentioned above. It is shown that the converse cannot be proven in general, however, if the conclusion of Ressayre's theorem is strengthened, a full equivalence is obtained. Dissert. Abstr.

N78-13840 Duke Univ., Durham, N. C.
LOCALLY BOUNDED TOPOLOGIES ON THE QUOTIENT FIELD OF A DEDEKIND DOMAIN Ph.D. Thesis
Jo-Ann Deborah Cohen 1976 67 p
Avail: Univ. Microfilms Order No. 77-18766

Locally bounded topologies on F(x) are classified where F is a discrete field and x is a transcendental element over F. Cohn's Theorem is used to solve this problem under the two additional hypotheses that F is a bounded subset of F(x) and that there exists a nonzero topological nilpotent. To solve the problem when there is no nonzero topological nilpotent, different techniques are needed. These techniques apply equally well to the more general problem of classifying locally bounded topologies on the quotient field of a Dedekind domain. Dissert. Abstr.

N78-13841 Montana Univ., Missoula.
ASPECTS OF CATEGORICAL TOPOLOGY Ph.D. Thesis
Vilas Edward Deane 1977 151 p
Avail: Univ. Microfilms Order No. 77-19617

Popular concepts from elementary general topology are reformulated in the language of category theory. The categorical nature of spacial topological objects and morphisms are enunciated. Initial and final topologies are emphasized. Subspaces and quotients are recognized not only because of the existence of initial and final topologies, respectively, but also because of the extremal monomorphisms and extremal epimorphisms, respectively, that are present. It is shown that the limit of any functor can be found by giving the initial topology with respect to the associated maps to the set which is the limit of U relative D, where U is the underlying set functor. Dissert. Abstr.

N78-13842 Vanderbilt Univ., Nashville, Tenn.
COMBINATORIAL CONSTRUCTION OF TOPOLOGICALLY ANALYTIC MAPS Ph.D. Thesis
Cloyd Lee Ezell, Jr. 1977 57 p
Avail: Univ. Microfilms Order No. 77-19371

Combinatorial definitions for two particular types of topologically analytic maps are discussed. Maps between unborded surfaces are treated as branched covers. A method for constructing branched covers is reported that considers the target space nonorientable. For the case where the domain space is bordered, the orientable surface and the images of the boundary components in the target space are curves called normal. This kind of topologically analytic map is considered a normal interior map. The constructional technique is applied to the case where the target space is any orientable surface. Dissert. Abstr.

N78-13843 Pennsylvania Univ., Philadelphia.
ABELIAN GROUP THEORY IN A TOPOS Ph.D. Thesis
Douglas James Howe 1977 91 p
Avail: Univ. Microfilms Order No. 77-19863

Aspects of Abelian group theory in a topos are considered where Abelian categories appear as the Abelian groups of topos (called Ab-topos). Considered is the problem to what extend uniqueness exists, i.e. where the Abelian groups of the topos E are denoted Abe. The basic assumption is that all topoi have an NNO sufficient for the existence of free Abelian groups in the topos. A loss of information was indicated in the passage from free functor to tensor product. Dissert. Abstr.

N78-13844 State Univ. of New York, Buffalo.
CONTRIBUTIONS TO THE THEORY OF 0-DIMENSIONAL HAUSDORFF SPACES Ph.D. Thesis

David William Jakel 1977 181 p
Avail: Univ. Microfilms Order No. 77-19447

Two topics in general topology are considered, namely: the images of spaces or ordinals under perfect maps, and the position of the class beta beta of all 0-dimensional realcompact spaces in which every zero set is Borel (CO). In connection with the first problem, it is shown that many kinds of spaces are images of spaces of ordinals under perfect maps. In particular, the class of all such images is closed under one-point compactification of free unions and under an operation we called the well-ordered union. In connection with the second problem it is known that beta beta contains the class z^* of all strongly 0-dimensional realcompact spaces and is contained in the class k(N) of all N-compact spaces, but it is also known that these two latter classes are not equal. Dissert. Abstr.

N78-13845 Cornell Univ., Ithaca, N. Y.
PATH SPACES WHICH ARE HILBERT CUBE MANIFOLDS Ph.D. Thesis
Alan Kenneth Jones 1976 71 p
Avail: Univ. Microfilms Order No. 77-18173

A theorem of Ross Geoghegan states that if N and M are Riemannian manifolds, N compact and M flat, then the closure in C(N,M) of the piecewise C maps of N into M with derivatives uniformly bounded by a fixed constant is a Hilbert cube manifold. The method of proof requires that this closure should be a locally convex subset of a Banach manifold, and the proof that this is true in the usual Banach structure on C(N,M) requires crucially that M be flat. The hypothesis of flatness is significantly weakened for certain choices of N. Dissert. Abstr.

N78-13846# South Carolina Univ., Columbia. Dept. of Mathematics and Computer Science.
CONCAVITY ARGUMENTS AND GROWTH ESTIMATES FOR LINEAR INTEGRODIFFERENTIAL EQUATIONS IN HILBERT SPACE I: UNDAMPED EQUATIONS AND APPLICATIONS TO MAXWELL HOPKINSON DIELECTRICS Interim Report
Frederick Bloom 1977 32 p refs
(Grant AF-AFOSR-3396-77)
(AD-A045838; AFOSR-77-1219TR) Avail: NTIS HC A03/MF A01 CSCL 20/3

Employing a modified version of a concavity argument for abstract differential equations, growth estimates are obtained for solutions to a class of initial-value problems associated with an undamped linear integrodifferential equation in Hilbert space; our results are applied to the derivation of growth estimates for the gradients of electric displacement fields occurring in rigid nonconducting material dielectrics of Maxwell-Hopkinson type. GRA

N78-13847# South Carolina Univ., Columbia. Dept. of Mathematics and Computer Science.
CONCAVITY ARGUMENTS AND GROWTH ESTIMATES FOR LINEAR INTEGRODIFFERENTIAL EQUATIONS IN HILBERT SPACE II. DAMPED EQUATIONS AND APPLICATIONS TO A CLASS OF HOLOHEDRAL ISOTROPIC DIELECTRICS Interim Report
Frederick Bloom 1977 31 p refs
(Grant AF-AFOSR-3396-77)
(AD-A045843; AFOSR-77-3396TR) Avail. NTIS HC A03/MF A01 CSCL 20/3

Concavity arguments are employed so as to obtain growth estimates for solutions to two initial-value problems associated with a class of damped integrodifferential equations in Hilbert space; by applying the results obtained in this abstract setting growth estimates are obtained for the gradients of electric displacement fields which occur in a class of holohedral isotropic nonconducting rigid dielectrics. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N78-13848*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPTICAL AND ELECTRICAL PROPERTIES OF ION BEAM TEXTURED KAPTON AND TEFLON
Michael J. Mirtich and James S. Sovey 1977 16 p refs Presented at 24th Natl. Vacuum Symp., Boston, 8-11 Nov. 1977; sponsored by Am. Vacuum Soc.
(NASA-TM-73778; E-9329) Avail: NTIS HC A02/MF A01 CSCL 11G

An electron bombardment argon ion source was used to ion etch polyimide (Kapton) and fluorinated ethylene, FEP (Teflon). Samples of polyimide and FEP were exposed to (0.5-1.0) keV Ar ions at ion current densities of (1.0-1/8) mA/sq cm for various exposure times. Changes in the optical and electrical properties of the samples were used to characterize the exposure. Spectral reflectance and transmittance measurements were made between 0.33 and 2.16 micron m using an integrating sphere after each exposure. From these measurements, values of solar absorptance were obtained. Total emittance measurements were also recorded for some samples. Surface resistivity was used to determine changes in the electrical conductivity of the etched samples. A scanning electron microscope recorded surface structure after exposure. Spectral optical data, resistivity measurements, calculated absorptance and emittance measurements are presented along with photomicrographs of the surface structure for the various exposures to Ar ions. Author

N78-13849# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON EASTERN EUROPE: SCIENTIFIC AFFAIRS, NO. 566
6 Dec. 1977 37 p Transl. into ENGLISH from Selected Foreign Periodicals (Hungary)
(JPRS-70283) Avail: NTIS HC A03/MF A01

Scientific research efforts in Hungary and Romania are reviewed, including articles concerning the programs of the Biological Research Center of Hungary, a review of the central party science policy in Hungary, and equipment developments and recovery maximization techniques of the Romanian petroleum industry. J.H.

N78-13850# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: PHYSICAL SCIENCES AND TECHNOLOGY, NO. 25
7 Dec. 1977 112 p Transl. into ENGLISH from Selected Foreign Periodicals (USSR)
(JPRS-70295) Avail: NTIS HC A06/MF A01

Translations and abstracts are presented of articles on cybernetics, computers, automation technology, geophysics, astronomy, space, electronics, and electrical engineering. Author

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N78-13851*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
INVESTIGATION OF ACOUSTIC PROPERTIES OF A RIGID FOAM WITH APPLICATION TO NOISE REDUCTION IN LIGHT AIRCRAFT
Curtis I. Holmer [1972] 79 p refs
(Contract NAS1-9559)
(NASA-CR-132333; Rept-2558) Avail: NTIS HC A05/MF A01 CSCL 20B

A analytic model of sound transmission into an aircraft cabin was developed as well as test procedures which appropriately rank order properties which affect sound transmission. The proposed model agrees well with available data, and reveals that the pertinent properties of an aircraft cabin for sound transmission include: stiffness of cabin walls at low frequencies (as this reflects on impedance of the walls) and cabin wall transmission loss and interior absorption at mid and high frequencies. Below 315 Hz the foam contributes substantially to wall stiffness and sound transmission loss of typical light aircraft cabin construction, and could potentially reduce cabin

noise levels by 3-5 db in this frequency range at a cost of about 0:2 lb/sq. ft. of treated cabin area. The foam was found not to have significant sound absorbing properties. Author

N78-13852*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SHAPE OPTIMIZATION OF PRESSURE GRADIENT MICROPHONES

Thomas D. Norum and John M. Seiner Dec. 1977 27 p refs Presented at 94th ASA Meeting, Miami Beach, Fla., 13-16 Dec. 1977

(NASA-TM-78632) Avail: NTIS HC A03/MF A01 CSCL 20A

Recently developed finite element computer programs were utilized to investigate the influence of the shape of a body on its scattering field with the aim of determining the optimal shape for a Pressure Gradient Microphone (PGM). Circular cylinders of various aspect ratios were evaluated to choose the length to diameter ratio best suited for a dual element PGM application. Alterations of the basic cylindrical shape by rounding the edges and recessing at the centerline were also studied. It was found that for a + or - 1 db deviation from a linear pressure gradient response, a circular cylinder of aspect ratio near 0.5 was most suitable, yielding a useful upper frequency corresponding to ka = 1.8. The maximum increase in this upper frequency limit obtained through a number of shape alterations was only about 20 percent. An initial experimental evaluation of a single element cylindrical PGM of aspect ratio 0.18 utilizing a piezoresistive type sensor was also performed and is compared to the analytical results. Author

N78-13853*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

NOISE OF DEFLECTORS USED FOR FLOW ATTACHMENT WITH STOL-OTW CONFIGURATIONS

U. vonGlahn and D. Groesbeck 1977 17 p refs Presented at 94th Meeting of Acoust. Soc. Am., Miami Beach, Fla., 13-16 Dec. 1977

(NASA-TM-73809; E-9392) Avail: NTIS HC A02/MF A01 CSCL 20A

Future STOL aircraft may utilize engine-over-the-wing installations in which the exhaust nozzles are located above and separated from the upper surface of the wing. An external jet flow deflector can be used with such installations to provide flow attachment to the wing/flap surfaces for lift augmentation. Deflector noise in the flyover plane measured with several model-scale nozzle/deflector/wing configurations is examined. The deflector-associated noise is correlated in terms of velocity and geometry parameters. The data also indicate that the effective overall sound pressure level of the deflector-associated noise peaks in the forward quadrant near 40 deg from the inlet axis. Author

N78-13854*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A PARAMETRIC INVESTIGATION OF AN EXISTING SUPERSONIC RELATIVE TIP SPEED PROPELLER NOISE MODEL

James H. Dittmar Nov. 1977 25 p refs

(NASA-TM-73816; E-9405) Avail: NTIS HC A02/MF A01 CSCL 20A

A high tip speed turboprop is being considered as a future energy conservative airplane. The high tip speed of the propeller combined with the cruise speed of the airplane may result in supersonic relative flow on the propeller tips. These supersonic blade sections could generate noise that is a cabin environment problem. An existing supersonic propeller noise model was parametrically investigated to identify and evaluate the noise reduction variables. Both independent and interdependent parameter variations (constant propeller thrust) were performed. The noise reductions indicated by the independent investigation varied from sizable in the case of reducing Mach number to minimal for adjusting the thickness and loading distributions. The noise reduction possibilities of decreasing relative Mach number were further investigated during the interdependent variations. The interdependent investigation indicated that significant noise reductions could be achieved by increasing the propeller diameter and/or increasing the number of propeller blades while maintaining a constant propeller thrust. Author

N78-13855*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FAR-FIELD MULTIMODAL ACOUSTIC RADIATION DIRECTIVITY

Arthur V. Saule and Edward J. Rice 1977 22 p refs Presented at 94th Meeting of the Acoustical Soc. of Am., Miami Beach, Fla., 12-16 Dec. 1977

(NASA-TM-73839; E-9426) Avail: NTIS HC A02/MF A01 CSCL 20A

Approximate equations for the far field acoustic radiation patterns in the forward quadrant from a flanged circular duct were compared with exact equations for both single and multimodal excitations. The single mode comparison showed good agreement between the exact and approximate equations for the principal lobes of higher radial order modes. For lower and especially for zero radial order modes, there was some error in the angular location and decibel level of principal lobe peak pressure obtained from the approximate equation. Some agreement of sidelobes was also observed although the approximate equation was not intended to simulate the sidelobes. The multimodal approximate summation equations consisting only of a simple function of directivity angle and an acoustic power biasing function were checked against the exact equations for several distributions of modal power and showed excellent agreement with exact equations for all cases. Although many modes contribute to the final level and shape of the directivity curve, the major contributions appear to come from the higher radial order modes. Author

N78-13856*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECTIVENESS OF AN INLET FLOW TURBULENCE CONTROL DEVICE TO SIMULATE FLIGHT NOISE FAN IN AN ANECHOIC CHAMBER

R. P. Woodward, J. A. Wazyniak, L. M. Shaw, and M. J. MacKinnon 1977 16 p refs Presented at the 94th Meeting of the Acoust. Soc. of Am., Miami, Fla., 13-16 Dec. 1977

(NASA-TM-73855; E-9444) Avail: NTIS HC A02/MF A01 CSCL 20A

A hemispherical inlet flow control device was tested on a 50.8 cm. (20-inch) diameter fan stage in the NASA-Lewis anechoic chamber. The control device used honeycomb and wire mesh to reduce turbulence intensities entering the fan. Far field acoustic power level results show about a 5 db reduction in blade passing tone and about 10 dB reduction in multiple pure tone sound power at 90% design fan speed with the inlet device in place. Hot film cross probes were inserted in the inlet to obtain data for two components of the turbulence at 65 and 90% design fan speed. Without the flow control device, the axial intensities were below 1.0%, while the circumferential intensities were almost twice this value. The inflow control device significantly reduced the circumferential turbulence intensities and also reduced the axial length scale. Author

N78-13857# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio. Turbine Engine Div.

PROPELLER ACOUSTICS TEST FACILITY (CAPABILITY DESCRIPTION) Final Technical Report, 1 Jan. 1970 - 31 Oct. 1976

Paul A. Shahady, Sigmund W. Kizirnis, and Robert M. McGregor Aug. 1977 101 p refs

(AF Proj. 3066)

(AD-A045409; AFAPL-TR-77-48) Avail: NTIS HC A06/MF A01 CSCL 20/1

This report describes the development of a research facility to investigate fan and propeller noise generation mechanisms. A 3500 horsepower electric whirl rig was modified to allow both near- and far-field acoustic testing. The rig is located in a large building with acoustically-treated walls. Reverberation time and sound pressure level measurements were conducted to determine the acoustic characteristics of the building. Acoustic data is acquired using a portable analog FM multichannel tape recorder system. The resultant data is frequency analyzed in one-third octave or narrow bonds. A series of data presentation programs have been developed to cross plot key performance and acoustic parameters. Author (GRA)

N78-13858# Stanford Univ., Calif. Edward L. Ginzton Lab.
SCANNING ACOUSTIC MICROSCOPE Annual Report, 1 Apr. 1976 - 31 Mar. 1977
C. F. Quate Apr. 1977 175 p refs
(Contract NSF APR-75-07317)
(PB-271443/4; GL-2701; NSF/RA-770132) Avail: NTIS HC A08/MF A01 CSCL 20A

The scanning acoustic microscope design is described including lens element design, instrument electronics and sensitivity, specimen support confocal alignment, and mechanical scanning system. Resolution performance, modifications of the thin lens model, and acoustic lens transfer functions are discussed. Examples of tissue micrographs for the illustration of the latest results obtainable with the instrument working near 1000 MHz, a study of the cells from the bloodstream; and suggestions for applications of acoustic microscopy are included. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N78-13859 California Univ., Berkeley.
PHOTOIONIZATION STUDIES WITH MOLECULAR BEAMS Ph.D. Thesis
Cheuk-Yiu Ng 1976 184 p
Avail: Univ. Microfilms Order No. 77-15800

A molecular beam photoionization apparatus was constructed using a differentially pumped windowless vacuum ultraviolet monochromator, a modulated supersonic beam production system, an ionization chamber, photon detectors, a low noise quadrupole mass spectrometer and intense continuum light sources (extending from 600 A to 2000 A). Rotational cooling during the supersonic expansion resulted in high resolution photoionization efficiency curves for NO, ICl, C2H2 and CH3I. The analysis of these spectra has yielded ionization potentials for these molecules to an accuracy of + or - 3 meV. Selection rules for autoionization were investigated and the Rydberg series which converge to the excited states of molecular ions were identified. The photoionization efficiency curves for (NO)2, ArICl, Ar2, Kr2 and Xe2 were obtained near the thresholds. Dissert. Abstr.

N78-13860 Connecticut Univ., Storrs.
ELECTRON SPIN RESONANCE STUDY OF RADIATION DAMAGE TO ORGANIC COMPOUNDS Ph.D. Thesis
Silvio DiGregorio 1977 102 p
Avail: Univ. Microfilms Order No. 77-16704

The products of X-irradiation damage to adamantane were investigated. The temperature of radiation and decay of radical products from adamantane was also obtained, and a distinction was made between the products of primary and secondary radiation processes. The incorporation of unsaturated aromatic organic compounds in adamantane followed by X-irradiation resulted in hydrogen atom addition radicals. The position of hydrogen atom addition was found to be predominantly ortho to the exo-groups, resulting in the cyclohexadienyl and ortho-substituted cyclohexadienyl radicals. INDO minimized geometries are presented and the prediction of hydrogen bonding between the exo-group and the methylene hydrogens is discussed. Photolysis of the cyclohexadienyl radicals resulted in disproportionation to yield benzyl type where possible. Hydrogen atom addition radicals were also prepared from five membered unsaturated heterocycles. The mechanism of hydrogen atom transfer in adamantane is discussed. Dissert. Abstr.

N78-13861 California Univ., Berkeley.
THE THEORY AND APPLICATIONS OF THE METHOD OF SELF-CONSISTENT ELECTRON PAIRS Ph.D. Thesis
Clifford Elliot Dykstra 1976 114 p
Avail: Univ. Microfilms Order No. 77-15667

The self-consistent electron pairs method is an iterative scheme which is shown to be a viable computational method for the determination of ab initio correlated molecular wavefunctions. Features of this method over conventional approaches are presented including the convenient calculation of variationally additive pair correlation energies, the representation of the wavefunction directly in terms of basis functions, and computational efficiency for many types of studies of molecular systems. Results of some representative studies of chemical systems presented include calculations performed for comparison with configuration interaction results and more extensive studies on a small beryllium metal cluster and planar and non-planar forms of allene. The interpretive value of pair correlation energies is indicated in the latter two studies. Dissert. Abstr.

N78-13862*# California Univ., Los Angeles. Chemical, Nuclear, and Thermal Engineering Dept.
INTERACTIONS OF SATELLITE-SPEED HELIUM ATOMS WITH SATELLITE SURFACES. 3: DRAG COEFFICIENTS FROM SPATIAL AND ENERGY DISTRIBUTIONS OF REFLECTED HELIUM ATOMS
P. K. Sharma and E. L. Knuth Dec. 1977 48 p refs
(Grant NGR-05-007-416)
(NASA-CR-155340) Avail: NTIS HC A03/MF A01 CSCL 20H

Spatial and energy distributions of helium atoms scattered from an anodized 1235-0 aluminum surface as well as the tangential and normal momentum accommodation coefficients calculated from these distributions are reported. A procedure for calculating drag coefficients from measured values of spatial and energy distributions is given. The drag coefficient calculated for a 6061 T-6 aluminum sphere is included. Author

N78-13863# Chicago Univ., Ill. Dept. of Chemistry.
MOLECULAR OPTICAL SPECTROSCOPY WITH SUPERSONIC BEAMS AND JETS
Richard E. Smalley, Lennard Wharton, and Donald H. Levy 1977 20 p refs
(Grant AF-AFOSR-2853-75)
(AD-A045167; AFOSR-77-1083TR) Avail: NTIS HC A03/MF A01 CSCL 20/8

This account is a description of a recent technique which is directed toward overcoming two difficulties which arise when one wishes to study the high resolution spectra of molecules. The first of these is the necessity of obtaining a sample of the molecules at a temperature which is low enough to prevent thermal dissociation and which contains population of only as many rotational and vibrational levels of the molecular system as can be separately assigned in the spectrum. The second difficulty lies in finding a medium which will support the molecular system at this low temperature without introducing undesirable changes and complications in the spectrum. A desirable spectroscopic sample would be an ensemble of molecules, all in a particular and well-defined quantum state (usually the lowest energy allowed state) traveling in free space with a narrow velocity distribution, and at a sufficiently low density so that intermolecular interactions are unimportant. The purpose of this account is to trace the progress of research in the application of supersonic beams and jets toward the solution of a number of problems in molecular optical spectroscopy and to illustrate the promise such experiments hold for future work. GRA

N78-13864# National Bureau of Standards, Boulder, Colo. Time and Frequency Div.
FREQUENCY STANDARDS AND CLOCKS: A TUTORIAL INTRODUCTION
Helmut Hellwig Jun. 1977 74 p Supersedes COM-74-50347
(PB-270723/0; NBS-TN-616-Rev-2; COM-74-503117) Avail: NTIS HC A04/MF A01 CSCL 14B

The topic of frequency standards and clocks is treated in a tutorial and non-mathematical way. The concepts of time, frequency, frequency stability and accuracy are introduced. The general physical principles and design features of frequency standards and clocks are described. The design, performance, and limitations of quartz crystal oscillators and atomic devices (cesium, hydrogen, rubidium) are discussed in detail and critically compared for laboratory devices as well as for devices intended for field usage. GRA

N78-13865# Ballistic Research Labs., Aberdeen Proving Ground, Md.

EFFECTS OF HIGH PRESSURE ON MOLECULAR ELECTRONIC SPECTRA: A COMPARISON OF MODELS
Robert C. Tompkins Sep. 1977 20 p refs
(AD-A045414; BRL-2014) Avail: NTIS HC A02/MF A01 CSCL 07/4

The experimental tests by Okamoto and Drickamer of the Drickamer model of high-pressure effects on electronic spectra are reexamined. Correctly interpreted the data contradict the model. However, it is shown that a theory of Lin is compatible with the data and shows promise of practical application.
Author (GRA)

N78-13866# Wisconsin Univ., Madison.
A PHOTOIONIZATION STUDY OF CLUSTER SPECIES PRESENT IN GAS VAPORS AND THOSE CREATED BY CONDENSATION IN A SUPERSONIC MOLECULAR BEAM Interim Report, 30 May 1976 - 31 Jul. 1977
James W. Taylor 30 Sep. 1977 13 p
(Contract N00014-75-C-0943)
(AD-A045442; N00014-75-C-0943-2) Avail: NTIS HC A02/MF A01 CSCL 07/4

This interim report summarizes the results of studies on clusters sampled by and produced through a supersonic molecular beam sampling system. Photoionization cross section measurements were used to calibrate mass spectral ion signals and to study beam discrimination effects. Heats of formation data were obtained for clusters of carbon dioxide, methanol, methanol-d1, ethanol, and trifluoroethanol. Author (GRA)

N78-13867# California Univ., Berkeley. Dept. of Chemistry.
LASER STUDIES OF MOLECULAR COLLISION PROCESSES Final Report, 1 Apr. 1974 - 30 Jun. 1977
C. Moore Oct. 1977 6 p
(Grant DAHC04-74-G-0148)
(AD-A045860; ARO-12224.12-P) Avail: NTIS HC A02/MF A01 CSCL 20/8

The purpose of this research has been to determine the effect of selective electronic and vibrational excitation on energy transfer and reaction rates in simple molecular systems. The combined use of selective excitation and final state resolution has demonstrated that a broad variety of behavior is exhibited in collisions of simple chemical species. The principal results can be grouped into three sets: (1) Influence of Reagent Energy on Chemical Reactions, (2) Vibrational Relaxation vs Reaction, and (3) Vibrational Relaxation in Polyatomic Systems.
Author (GRA)

N78-13868# Addis Translations International, Portola Valley, Calif.
ISOTOPIC EFFECTS AND THERMODYNAMIC PROPERTIES IN CONDENSED PHASES, 1
I. Prigogine, R. Bingen, and J. Jeener Apr. 1977 21 p Transl. into ENGLISH from Physica (Netherlands), v. 20, no. 7, 1954 p 383-394 Prepared for Calif. Univ., Lawrence Livermore Lab. Sponsored by ERDA 3 Vol.
(UCRL-Trans-11239) Avail: NTIS HC A02/MF A01

The zero point energy of solid isotope mixtures is discussed and their properties are compared with those of the pure isotopes. The case of a one-dimensional chain of molecules is considered in some detail because the calculations may then be performed in a rigorous way. Only harmonic oscillators are considered. It is shown that the zero point energy increases steadily with the number of couples of first neighbors between molecules of different masses. The zero point energy is lowest for the pure isotopes and highest for the ordered lattice ABAB ... . Also its value for a random distribution of the isotopes is higher than that for the pure isotopes. The stable state of 0 K always requires a separation into pure isotopes. Differences in masses, i.e., isotopic effects, may give positive deviations from Raoult's law without any effect of the statistics. The possibility of pure quantum transitions in the phase diagram due to isotopic effects at sufficiently low temperatures is indicated. ERA

N78-13869# Addis Translations International, Portola Valley, Calif.
ISOTOPIC EFFECTS AND THERMODYNAMIC PROPERTIES IN CONDENSED PHASES, 2
I. Prigogine and J. Jeener Apr. 1977 10 p Transl. into ENGLISH from Physica (Netherlands), v. 20, no. 8, 1954 p 516-520 Prepared for Calif. Univ., Lawrence Livermore Lab. Sponsored by ERDA 3 Vol.
(UCRL-Trans-11240) Avail: NTIS HC A02/MF A01

The zero point energy is calculated for isotopic mixtures and pure isotopes using three dimensional lattices. The results obtained for one dimensional lattices are shown to remain qualitatively valid for three dimensional lattices; however, the heat of mixing is smaller than in the one-dimensional case. The stable state at 0 K always requires a separation into pure isotopes. ERA

N78-13870# Addis Translations International, Portola Valley, Calif.
ISOTOPIC EFFECTS AND THERMODYNAMIC PROPERTIES IN CONDENSED PHASES, 3
I. Prigogine, R. Bingen, and R. Bellemans Apr. 1977 36 p refs Transl. into ENGLISH from Physica (Netherlands), v. 20, no. 9, 1954 p 633-654 Prepared for Calif. Univ., Lawrence Livermore Lab. Sponsored by ERDA 3 Vol.
(UCRL-Trans-11241) Avail: NTIS HC A03/MF A01

The difference in zero-point energy of isotopic mixtures as compared with its value for pure isotopes was shown to be much smaller than the experimental value of the free energy of mixing for isotopic liquid mixtures of light molecules such as H(2)-D(2) and He(3)-He(4). The volume of the isotopic mixture and that of the pure isotopes are different (for given pressure and temperature values). The basic assumption given is therefore introduced in the following form: the free energy of an isotopic mixture is, for given values of volume per particle and temperature, the sum of the free energy of the pure isotopes and of a term due to the entropy of mixing. From this hypothesis the free energy of mixing, the excess volume and the heat of mixing can be expressed in terms of properties of the pure isotopes only. This theory predicts for isotopic mixtures heat absorption and positive deviations from Raoult's law (positive excess free energy and thus phase separation at sufficiently low temperature). ERA

N78-13871# Los Alamos Scientific Lab., N. Mex.
LASER SPECTROSCOPY
K. C. Kim, J. P. Aldridge, H. Filip, H. Flicker, R. F. Holland, N. G. Nereson, and W. B. Person (Florida Univ., Gainsville) 1975 19 p refs Presented at the Electro-Optics Intern. Laser '75 Conf., Anaheim, Calif., 11-13 Nov. 1975
(Contract W-7405-eng-36)
(LA-UR-75-1940; Conf-751102-5) Avail: NTIS HC A02/MF A01

In recent years considerable progress has been made in the use of semiconductor lasers as one of the principal methods of investigating polyatomic molecular structure. Lasers have been made from many materials, and the wavelength of coherent radiation has been extended to cover molecular transitions in the spectral range from the ultraviolet to the far infrared. Diode spectroscopy has found its widest application in laser isotope separation as a diagnostic tool. The laser line for isotope separation is very narrow. Therefore, the selectivity of laser isotope separation for many polyatomic molecules requires very accurate measurements of resonant line positions which are not readily obtainable by conventional methods. This paper discusses work conducted in molecular spectroscopy using current and magnetically tuned PbSnSe (or PbSnTe) diode lasers. ERA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N78-13872 Cornell Univ., Ithaca, N. Y.
AN EXPERIMENTAL STUDY OF SHADOWING IN ELECTROPRODUCTION FROM NUCLEI Ph.D. Thesis
John Richard Eickmeyer 1976 122 p
Avail: Univ. Microfilms Order No. 77-18869

The inelastic cross section of electrons on complex nuclei was determined by detecting the scattered electron at a fixed angle of 3.2 degrees in coincidence with at least one produced hadron. For the targets hydrogen, deuterium, carbon, aluminum, copper, and tantalum data were taken at a fixed four-momentum transfer, sq Q, of 0.1 sq GeV and several values of the electron's energy loss v. The data are compared with theoretical values of the shadowing factor which measures the effective number of nucleons participating in the reaction. The experimentally-determined shadowing factor is found to be constant with v and larger than measured in photoproduction experiments. These results are in disagreement with calculations assuming vector meson dominance of the electroproduction cross section.
Dissert. Abstr.

N78-13873# Westfield Coll., London (England). Dept. of Physics.
SPIN DEPENDENT PHENOMENA INDUCED BY ELECTRO-MAGNETIC-HADRONIC INTERFERENCE AT HIGH ENERGIES
N. H. Buttimore (Trinity Coll., Dublin), E. Gotsman (Tel-Aviv Univ., Israel), and E. Leader May 1977 106 p refs Submitted for publication Sponsored in part by Israel Comm. for Basic Res.
Avail: NTIS HC A06/MF A01

Interference phenomena should be seen in many spin dependent observables for the collision of spin-half hadrons. The phenomena occur both in the collision of charged particles and in the collision of neutral particles with charged particles. Of most direct interest are the reactions pp gives pp, np gives np, and lamdap gives lamdap. Much information about the phases of the helicity-flip amplitudes near the forward direction can be obtained from the measurement of the interference. Detailed expressions are given for many experimental observables in the interference region, and the extraction of the hadronic amplitudes is discussed in depth. The existence of a new type of enhanced order alpha correction to the hadronic amplitudes is exhibited and its consequences are explored. In particular the role of electromagnetically induced helicity-flip outside the interference regions is stressed and shown to complicate the interpretation of the small measured values of the polarization at Fermilab energies.
Author (ESA)

74 OPTICS

Includes light phenomena.

N78-13874* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE 2 DEG/90 DEG LABORATORY SCATTERING PHOTOMETER Patent
William R. McCluney, inventor (to NASA) Issued 11 Oct. 1977 6 p Filed 13 Jan. 1976 Supersedes N76-17369 (14 - 08, p 0976)
(NASA-Case-GSC-12088-1; US-Patent-4,053,229; US-Patent-Appl-SN-648700; US-Patent-Class-356-103; US-Patent-Class-356-104) Avail: US Patent Office CSCL 20F

A scattering photometer for measuring the light scattered by particles in a hydrosol at substantially 2 deg and 90 deg simultaneously is described. Light from a source is directed by a first optical system into a scattering cell containing the hydrosol under study. Light scattered at substantially 90 deg to the incident beam is focused onto a first photoelectric detector to generate an electrical signal indicative of the amount of scattered light at substantially 90 deg. Light scattered at substantially 2 deg to the incident beam is directed through an annular aperture symmetrically located about the axis of the illuminating beam which is linearly transmitted undeviated through the hydrosol and focused onto a second photoelectric detector to generate an electrical signal indicative of the amount of light scattered at substantially 2 deg.
Official Gazette of the U.S. Patent Office

N78-13875 British Library Lending Div., Boston Spa (England).
INTEGRAL AND SPECTRAL CHARACTERISTICS OF THE REFLECTION, TRANSMISSION AND ABSORPTION OF LIGHT BY STRATUS IN THE 0.35 - 0.95 MICRON BAND
K. Ya. Kondratyev [1977] 10 p refs Transl. into ENGLISH from Nauchn. Issled. Gidromet. Inst., Radiat. Process. Atmos. Earth's Surf. (Kiev), 1974 p 38-45
(BLL-M-24903-(5828.4F); BLL-Trans-1269) Avail: British Library Lending Div., Boston Spa, Engl.

Two aircraft, flying parallel courses made simultaneous measurements both of cloud radiation characteristics, and of the meteorological parameters of the atmosphere and clouds. The processed data was studied to determine regularities in the variability of spectral reflection, transmission, and absorption of short wave radiation by stratus clouds. Topics discussed include: downward and upward fluxes of radiation above a cloud; shortwave radiation passing through a cloud; spectral albedo of clouds as a function of optical thickness and the albedo of the underlying surface; spectral albedo of cloud cover as a function of the concentration, the modal radius of cloud droplets, and of the phase of the cover; and spectral distribution of the radiation balance at heights of 1.0 and 0.2 km, and of the radiative heat flux for a single unbroken layer of cloud.
A.R.H.

N78-13876*# Honeywell, Inc., Lexington, Mass. Electro-Optics Center.
DETECTION OF LONG WAVELENGTH INFRARED AT MODERATE TEMPERATURES Final Report
T. J. Tredwell Apr. 1977 191 p refs
(Contract NAS9-14180)
(NASA-CR-151559) Avail: NTIS HC A09/MF A01 CSCL 20F

Technical approaches for the advanced development of 8-12 micrometer detectors operating at elevated temperatures were defined. The theoretical limits to performance of 8-12 micrometer quantum detectors (photoconductive and photovoltaic) and thermal detectors (pyroelectrics, bolometers etc). An analytic model of signal and noise in both quantum detectors and pyroelectric detectors was developed and candidate materials for both detector types were identified and examined. The present status of both quantum and thermal detectors was assessed as well as the parameters limiting operating temperature and detectivity. The areas of research and development likely to lead to detector performance near the theoretical limit are identified.
Author

N78-13877*# Southern Univ., Baton Rouge, La. Dept. of Mechanical Engineering.
DETERMINATION OF PARTICLE SIZE USING MEASUREMENT OF SCATTER Final Report
Robert Lloyd Scott, Jr. Oct. 1977 32 p
(Grant NGR-8029)
(NASA-CR-155333) Avail: NTIS HC A03/MF A01 CSCL 20F

Scatter measurements were taken from glass spheres of size 5 to 50 microns placed on a mirror to see whether such scatter data could be correlated with size. The spheres were illuminated with a laser whose wavelength was 0.62 microns. A Gonioreflectometer was used to vary the detector between the normal to the mirror and 85 deg from the normal and in the plane containing the normal to the mirror and the incident laser light. The azimuth of the detector with respect to the source was 180 deg. The light detector was driven by a step motor. The scatter was dark and bright lines. They appeared as minima and maxima on the output recorder. As the size of the beads increased the number of maxima increased.
Author

N78-13878# Express Translation Service, London (England).
OPTICAL THIN FILMS: THEIR THEORY, DESIGN AND MANUFACTURE. 2: DESIGN (1)
H. Ikeda Ottawa Can. Inst. for Sci. Tech. Inform. 1977 33 p ref Transl. into ENGLISH from Kogaku (Japan), v. 3, 1974 p 178-188
(NRC/CNR-TT-1906; ISSN-0077-5606-Pt-1) Avail: NTIS HC A03/MF A01

Theoretical equations used for the design of multilayer films are presented; film design is then described by the series expansion method, from the standpoint of estimating structure by the spectroscopic characteristics obtained. The analytic synthesis methods are also described from the standpoint of constructing a multilayer film on the basis of ideal spectroscopic characteristics, and finally optical thin-film design techniques are referred to

with respect to the establishment of an automatic designing system. Author

N78-13879# Express Translation Service, London (England).
OPTICAL THIN FILMS: THEIR THEORY, DESIGN AND MANUFACTURE. 2: DESIGN (2)
H. Ikeda Ottawa Can. Inst. for Sci. and Tech. Inform. 1977 43 p refs Transl. into ENGLISH from Kogaku (Japan), v. 3, 1974 p 309-323
(NRC/CNR-TT-1907; ISSN-0077-5606-Pt-2) Avail: NTIS HC A03/MF A01
For abstract, see N78-13878.

N78-13880# Lockheed Missiles and Space Co., Palo Alto, Calif.
EXPERIMENTAL INVESTIGATION OF THE REFLECTION COEFFICIENTS OF SPECULAR SURFACES
Iu. Z. Mavashev, V. L. Rudshtein, F. S. Salikhov, G. V. Khudaeva, and I. A. Valeeva 1977 4 p Transl. into ENGLISH from Geliotekhnika (USSR), no. 4, 1977 p 26-29
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

An apparatus with a vacuum chamber, a radiation source, a reflected light flux receiver, and a measuring device was constructed to investigate the influence of temperature loads and certain vapors and gases on the coefficient of specular reflection of 25 mm diameter 1 mm thick discs of electrically polished aluminum, and aluminum atomized on an electrically polished surface in a .0001 torr vacuum. The change in the integrated reflection coefficient of specimens as a function of specimen temperature, their cooling time, and a different degree of vacuum in the apparatus, as well as the influence of water vapor and carbon dioxide artificially introduced into the working chamber indicate that electrically polished specular surfaces are preferable for specular elements in solar power plants which should operate under vacuum and low temperature conditions in the presence of vapors and gases. A.R.H.

N78-13881# Westinghouse Research Labs., Pittsburgh, Pa.
DEVELOPMENT OF MULTISPECTRAL SANDWICH-TYPE IR WINDOWS Final Report, 1 Feb. 1976 - 31 Jan. 1977
W. E. Kramer, R. A. Hopkins, G. B. Brandt, R. A. Hoffman, and J. Schruben Apr. 1977 81 p refs
(Contract F33615-76-C-5085)
(AD-A045655; Rept-77-9C4-WINDO-R1; AFML-TR-77-53) Avail: NTIS HC A05/MF A01 CSCL 17/5

Composite or sandwich-type multispectral windows up to 4 x 6 inch in size have been fabricated by a Westinghouse-developed technique called optical brazing. Of the numerous cladding, substrate and adhesives tested, the ZnS/ZnSe composite window is now the most promising for airborne common aperture systems. Optical path differences in the assembled windows stem mainly from material property variations in the component parts, not from the binding agent. These path differences can for the most part be corrected during final polishing of the composite window. The ZnS/ZnSe window transmittance with AR coating exceeds the 60% visible wavelength and 1.06 and 95% 8-12 micrometer transmittance requirements. Composite window specimens are as rain erosion resistant as monolithic ZnS. Optical brazing is a versatile technique for composite window fabrication and has been used to join other cladding and substrate combinations such as MgF2/ZnSe. Author (GRA)

N78-13882# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
EFFECT OF WEATHER AT HANOVER, FEDERAL REPUBLIC OF GERMANY, ON PERFORMANCE OF ELECTROOPTICAL IMAGING SYSTEMS. THE CALCULATION METHODOLOGY FOR A FLIR USING A FORTRAN PROGRAM Final Report, Jul. 1975 - Jul. 1977
Lynne N. Seekamp Aug. 1977 41 p refs
(Contract DAHC15-73-C-0200)
(AD-A045090; N-842) Avail: NTIS HC A03/MF A01 CSCL 17/5

This paper documents the computer program (called Program FLIR) to calculate the probabilities of detection and recognition of a target by an observer using a FLIR sensor. It was written to summarize the basic concepts behind the calculation procedures in Program FLIR and to outline those procedures. Author (GRA)

N78-13883# Maryland Univ., College Park. Computer Science Center.
SEGMENTATION OF FLIR IMAGES BY PIXEL CLASSIFICATION
Durga P. Panda Feb. 1977 18 p refs
(Contract DAAG53-76-C-0138; ARPA Order 3206)
(AD-A045334; TR-508) Avail: NTIS HC A02/MF A01 CSCL 17/5

Image segmentation can be treated as a point-wise classification problem. This classification may be done by measuring a set of features at each point and defining a decision surface in the feature space. This report presents some experiments in segmenting FLIR images by using the gray level and the edge value at each point as features. Author (GRA)

N78-13884# Northrop Research and Technology Center, Hawthorne, Calif.
OPTICAL COATINGS 2-6 MICRONS Progress Report, Jan. - Jun. 1977
P. Kraatz Sep. 1977 63 p refs
(Contract N00123-76-C-1321)
(AD-A045598) Avail: NTIS HC A04/MF A01 CSCL 11/3

The report is divided into four sections covering coating materials and deposition, coating structure, orientation, and growth rates, coating properties (refractive indices and absorption coefficients), and future plans. The materials include sapphire; fluorides of lanthanum, lead, magnesium, strontium; thorium; silicon oxide, magnesium oxide; zinc sulfide, zinc selenide; lanthanum oxyfluoride. GRA

N78-13885# Stanford Univ., Calif.
PHOTON LIMITATIONS IN IMAGING AND IMAGE RESTORATION
J. W. Goodman and J. F. Belsher May 1977 37 p refs
(Contracts F30602-75-C-0228; ARPA Order 2646)
(AD-A045545; RADC-TR-77-165) Avail: NTIS HC A03/MF A01 CSCL 20/6

This report describes progress made in image quality factors, limiting performance of speckle and amplitude interferometry, and formulation of a least-squares filtering problem for space-variant degradations. This work is in photon-limited imaging systems, their limitations, and the restorability of their imagery. Author (GRA)

N78-13886# Office of Naval Research, London (England).
OPTICAL FIBERS, INTEGRATED OPTICS AND THEIR MILITARY APPLICATIONS
Vern N. Smiley 29 Aug. 1977 14 p Conf. held at London, England, 16-20 May 1977
(AD-A045704; ORNL-C-12-77) Avail: NTIS HC A02/MF A01 CSCL 20/6

A review is given of some of the papers presented at a Conference which was held in London. Emphasis is placed on past, present, and future devices for military applications. The review is organized in the same manner as the Conference format under the subtitles: systems, integrated optics, propagation, sources and detectors, and couplers. GRA

N78-13887# California Univ., Livermore. Lawrence Livermore Lab.
DETERMINATION OF PULSE BROADENING IN OPTICAL FIBERS FROM NUMERICAL SOLUTIONS OF A WAVE EQUATION
M. D. Feit and J. A. Fleck, Jr. May 1977 24 p
(Contract W-7405-eng-48)
(UCID-17481) Avail: NTIS HC A02/MF A01

Dispersion is one of the most important properties of optical fibers, since it determines their information carrying capacity. In the past, estimates of fiber dispersion have been based on a highly approximate modal analysis. A new method based on accurate numerical solutions of Maxwell's wave equation for calculating pulse dispersion in graded index fibers is described. The methods discussed should also be useful studying many properties of fiber optic transmission. ERA

N78-13888# Technische Physische Dienst TNO-TH, Delft (Netherlands). Afdel. Electron Optics.
DESIGN OF A PMA FOR FOCUSING A 4-STAGE IMAGE INTENSIFIER Final Report

P. vanZuylen Paris ESA 14 Apr. 1977 55 p refs
(Contract ESA-2489/75-PP)
(TPD-504.224; ESA-CR(P)-966) Avail: NTIS HC A04/MF A01

A permanent magnet assembly (PMA) was developed for focusing an image intensifier type EMI 9912, to be used in a spaceborne image photon counting system. The design is very simple and can easily be optimized for other image intensifiers. The selected design is based on a configuration called the Poole design. The mass of the PMA is only 15 kg and has a very low stray magnetic field. Due to material problems in the magnetic material, a polymer based Samarium Cobalt material (Hera) used in the construction, the full performance specifications are not met, but solutions to these problems are proposed. The feasibility of developing a permanent magnet assembly for focusing an image intensifier in space is demonstrated. ESA

N78-13889# National Bureau of Standards, Washington, D. C. Analytical Chemistry Div.
PROCEEDINGS OF THE WORKSHOP SEMINAR ON STANDARDIZATION IN SPECTROPHOTOMETRY AND LUMINESCENCE MEASUREMENTS Final Report
K. D. Mielenz, R. A. Velapoldi, and R. Maurodineanu May 1977 153 p refs Proc. held at Gaithersburg, Md., 19-20 Nov. 1975
(PB-270725/5; NBS-SP-466; LC-77-4739) Avail: NTIS HC A08/MF A01 CSCL 20F

Problems encountered where accurate measurements are required in the fields of luminescence quantum yields, diffuse reflectance spectroscopy, and ultraviolet absorption spectrometry are discussed. The needs for standardization of measurements in these fields are defined along with materials that could be used as standard reference materials. Considerations on some applications of such standards in the area of environmental pollution and health are included. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N78-13890*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH-TEMPERATURE, HIGH-POWER-DENSITY THERMIONIC ENERGY CONVERSION FOR SPACE
James F. Morris 23 Nov. 1977 17 p refs
(NASA-TM-73844; E-9431) Avail: NTIS HC A02/MF A01 CSCL 20I

Theoretic converter outputs and efficiencies indicate the need to consider thermionic energy conversion (TEC) with greater power densities and higher temperatures within reasonable limits for space missions. Converter-output power density, voltage, and efficiency as functions of current density were determined for 1400-to-2000 K emitters with 725-to-1000 K collectors. The results encourage utilization of TEC with hotter-than-1650 K emitters and greater-than-6W sq cm outputs to attain better efficiencies, greater voltages, and higher waste-heat-rejection temperatures for multihundred-kilowatt space-power applications. For example, 1800 K, 30 A sq cm TEC operation for NEP compared with the 1650 K, 5 A/sq cm case should allow much lower radiation weights, substantially fewer and/or smaller emitter heat pipes, significantly reduced reactor and shield-related weights, many fewer converters and associated current-collecting bus bars, less power conditioning, and lower transmission losses. Integration of these effects should yield considerably reduced NEP specific weights. Author

N78-13891# Los Alamos Scientific Lab., N. Mex. Theoretical Div.
APPLICATION OF THE SENSITIVITY AND UNCERTAINTY ANALYSIS SYSTEM LASS TO FUSION REACTOR NUCLEONICS
Donald J. Dudziak, S. A. W. Gerstl, and D. W. Muir 1976 23 p refs Presented at Specialists Meeting on Nucl. Data Requirements for Shielding, Vienna, Austria, 8-15 Oct. 1976
(Contract W-7405-eng-36)
(LA-UR-77-392; Conf-761081-1) Avail: NTIS HC A02/MF A01

The primary output from the sensitivity system LASS is the uncertainty (or change) in important reactor parameters. Applications of LASS and its component parts were made to the Tokamak Fusion Test Reactor the Reference Theta-Pinch Reactor, and to an Experimental Power Reactor (EPR). This paper emphasizes the initial assessment of cross-section sensitivity for an EPR design. Nucleonic responses examined include neutron and gamma-ray kerma in the toroidal field coils and Mylar superinsulatoroidal field coils, and activation of the outboard dewar. Experience at LASL with sensitivity and uncertainty analysis techniques incorporated in LASS has provided convincing evidence of their value for fusion studies. Many of these studies are of a shielding nature; e.g., deep penetrations of high-energy neutrons through steel, lead, boron carbide, and graphite, with responses such as activation and kerma. ERA

N78-13892# Energy Research and Development Administration, Washington, D. C. Div. of Magnetic Fusion Energy.
MULTIPLE-COMPONENT MATERIALS TEST FACILITIES FOR MAGNETIC FUSION ENERGY
Apr. 1977 49 p refs
(ERDA-77-52) Avail: NTIS HC A03/MF A01

Surface measurements in confinement experiments detected changes in elemental wall surface composition with plasma exposure, and these changes were correlated with plasma contamination. However, present measurements are not able to detect major erosion or surface modification, which are expected only at reactor fluences. The timing, utility, and need for a multi-component surface effects facility designed for the simultaneous bombardment of materials by all the radiation coming out from a fusion plasma is examined. Synergism is defined and examples of synergistic effects which are relevant to magnetic fusion energy surface considerations are given as well as plasma-originated radiations for a number of near- and long-term devices. Preliminary specifications are presented for a multi-component facility without neutrons. In-plasma experiments are discussed including reliability, neutron effects, and simulation. ERA

N78-13893# Princeton Univ., N. J. Plasma Physics Lab.
REDUCTION IN FUSION-NEUTRON PRODUCTION IN NONAXISYMMETRIC TOKAMAK DEVICES
D. L. Jassby, H. H. Towner, R. J. Goldston, and R. R. Parker May 1977 28 p refs
(Contract EY-76-C-02-3073)
(PPPL-1300) Avail: NTIS HC A03/MF A01

In Tokamak plasmas subjected to substantial toroidal-field ripple, sufficiently energetic members of the bulk-iron population can diffuse rapidly away from the hot central region by the super-banana process. The result is a truncation of the ion velocity distribution, causing a marked reduction in the fusion reactivity. This tail-depletion effect may account in part for the anomalously low central ion temperature deducted from the neutron flux emitted from dense deuterium plasmas in the Alcator device, and also may have relevance to similar observations in the beam-heated TFR plasma. ERA

N78-13894# Princeton Univ., N. J. Plasma Physics Lab.
THREE-DIMENSIONAL PLASMA SIMULATION MODELS AND THEIR APPLICATION TO MAGNETICALLY CONFINED PLASMAS
Hideo Okuda Mar. 1977 62 p refs Presented at Lecture on Theoret. and Computational Plasma Physics, Trieste, Italy, 29 Mar. - 9 Apr. 1977
(Contract EY-76-C-02-3073)
(PPPL-13) Avail: NTIS HC A04/MF A01

Three-dimensional plasma simulation models using particles have been described and applied to the various microscopic processes in a plasma in a magnetic field. The model makes use of the hybrid approach using eigenfunction expansion in one direction and multipole expansion on a two-dimensional spatial grid introduced in the cross section of a plasma. The models for cylindrical and toroidal systems correctly reproduce the expected fluctuation spectrum in thermal equilibrium. Application to the study of anomalous plasma diffusion due to collisionless

drift instabilities in a cylindrical plasma is shown. Some considerations are given as to how to construct a quasi-neutral particle simulation model and particle-fluid hybrid plasma model which eliminate the high frequency oscillations associated with the electrons. ERA

N78-13895# California Univ., Livermore. Lawrence Livermore Lab.
SCATTERED LIGHT EVIDENCE FOR SHORT DENSITY SCALE HEIGHTS NEAR CRITICAL DENSITY IN LASER-IRRADIATED PLASMAS
D. W. Phillion, R. A. Lerche, V. C. Rupert, R. A. Haas, and M. J. Boyle 15 Sep. 1976 27 p refs Presented at Plasma Phys. Meeting of the Am. Phys. Soc., San Francisco, 15-19 Nov. 1976 Revised
(Contract W-7405-eng-48)
(UCRL-78444-Rev-2; Conf-761108-26) Avail: NTIS HC A03/MF A01

Experimental evidence is presented of a steepened electron density profile near critical density obtained from studying the time-integrated scattered light from targets illuminated by linearly polarized, 1.06 micron light. Both 10 micron thick disks and DT-filled glass microshells were irradiated by light focused by f/1 or f/2.5 lenses in one and two-beam experiments, respectively. From the dependence of the asymmetry of the scattered light about the beam axis upon the scattering angle, we infer scale lengths on the order of one micron. Scale lengths have also been deduced from measurements on the polarization state of the reflected light. Both analytic and numerical results are presented to show how the polarization state varies with the incidence angle and the scale length. ERA

N78-13896# Brookhaven National Lab., Upton, N. Y.
DEALS: A DEMOUNTABLE EXTERNALLY ANCHORED LOW STRESS SUPERCONDUCTING MAGNET SYSTEM FOR FUSION REACTORS
James Powell, David Hsieh, and John Lehner Jan. 1977 79 p refs
(Contract EY-76-C-02-0016)
(BNL-50616) Avail: NTIS HC A05/MF A01

A type of superconducting magnet system for large fusion reactors is described. Instead of winding large planar or multiaxis coils, the superconducting coils are made by joining together several prefabricated conductor sections. The conductor stress level in the assembled coil can be kept small by external support of the coil at a number of points along its perimeter, so that the magnetic forces are transmitted to an external warm reinforcement structure. This warm reinforcement structure can also be the primary containment for the fusion reactor, constructed similar to a prestressed concrete reactor vessel used in fission reactors. Low thermal conductivity, high strength supports are used to transfer the magnetic forces to the external reinforcement through a hydraulic system. The hydraulic supports are movable and can be programmed to accommodate thermal contraction and to minimize stress in the superconducting coil. The potential benefits and penalties associated with this concept are summarized. ERA

N78-13897# Brookhaven National Lab., Upton, N. Y.
ASPECTS OF SAFETY AND RELIABILITY FOR FUSION MAGNET SYSTEMS Annual Report
J. Powell, ed. 15 Jan. 1976 452 p refs
(Contract EY-76-C-02-0016)
(BNL-50542; AR-1) Avail: NTIS HC A20/MF A01

General systems aspects of fusion magnet safety are examined including thermal, electrical, and other factors related to fusion magnet safety. The design examples chosen for analysis are illustrative and are not intended to be definitive, because fusion magnet designs are rapidly evolving. Design and operating data relating to the safety of existing superconducting magnet systems are reported as well as the principal conclusions developed from the work to date. ERA

N78-13898# Energy Research and Development Administration, Washington, D. C. Div. of Magnetic Fusion Energy.
FUSION POWER BY MAGNETIC CONFINEMENT: QUESTIONS AND ANSWERS
F. E. Coffman, M. R. Murphy, D. W. Kearney (General Atomic Co.), K. R. Schultz (General Atomic Co.), and B. L. Scott (General Atomic Co.) May 1977 45 p refs
(ERDA-77-63) Avail: NTIS HC A03/MF A01

The basic facts about fusion and the technical challenges which must be solved before it can become a commercial reality are discussed. The booklet is in a question and answer format. The technology and goals of the fusion program are described. Author (ERA)

N78-13899# Energy Research and Development Administration, Washington, D. C. Div. of Magnetic Fusion Energy.
SUMMARY OF THE PROGRAMS OF THE SYSTEMS AND APPLICATIONS STUDIES BRANCH
Michael R. Murphy, ed. Mar. 1977 138 p
(ERDA-77-28) Avail: NTIS HC A07/MF A01

Summaries are given of the current contract activities managed by the Systems and Applications Studies Branch in the areas of Fusion Systems Engineering and Environment and Safety. Author (ERA)

N78-13900# General Atomic Co., San Diego, Calif.
DOUBLET FUSION EXPERIMENTAL POWER REACTOR CONCEPTUAL DESIGN STUDY. VOLUME 4: SUMMARY REPORT
Dec. 1976 37 p
(EPRI Proj. 323-1)
(EPRI-ER-289-SY-Vol-4) Avail: NTIS HC A03/MF A01

Fusion reactor design concepts are discussed. The following sections are included: (1) basic reactor concepts, (2) reactor design, (3) plasma performance characteristics, (4) reactor components, (5) auxiliary systems, (6) maintenance concept, (7) EPR facility, (8) schedule, and (9) cost estimates. ERA

N78-13901# Los Alamos Scientific Lab., N. Mex.
GROWTH AND SATURATION OF INSTABILITY OF SPHERICAL IMPLOSIONS DRIVEN BY LASER OR CHARGED PARTICLE BEAMS
R. L. McCrory (Rochester Univ.), R. L. Morse (Ariz. Univ., Tucson), and K. A. Taggart 1977 41 p refs Presented at the Analysis of Nucl. Systems Meeting, Tucson, Ariz., 27-30 Mar. 1977
(Contract W-7405-eng-36)
(LA-UR-77-860; Conf-770304-13) Avail: NTIS HC A03/MF A01

The inertial confinement approach to controlled fusion requires that small thin walled spherical shells of fuel and other materials be imploded, compressed and heated by laser or charged particle beams. In most cases of interest the implosion of such thin shells is unstable to the growth of spherical asymmetries. Two numerical simulation techniques were developed to study these instabilities. The first technique is used to study the small amplitude growth of the instabilities by employing a perturbation method. The derivation of the Hamiltonian model on which the technique is based is developed here. The second technique is a fully nonlinear two dimensional hydrodynamics and heat flow technique which traces the large amplitude development and saturation of the instabilities. The examples of calculations shown demonstrate the utility of the method and the range of different saturation phenomena which may be expected. ERA

N78-13902# Los Alamos Scientific Lab., N. Mex.
APPLICATION OF THE 3D ICED-ALE METHOD TO EQUILIBRIUM AND STABILITY PROBLEMS OF A MAGNETICALLY CONFINED PLASMA
D. C. Barnes and J. U. Bracbill 1977 51 p refs Presented at the Am. Nucl. Soc. Topical Meeting: Improved Methods for Analysis of Nuc. Systems, Tucson, Ariz., 28-30 Mar. 1977
(Contract W-7405-eng-36)
(LA-UR-77-105; Conf-770304-10) Avail: NTIS HC A04/MF A01

A numerical study of the equilibrium and stability properties of the Scyllac experiment is described. The formulation of the numerical method, which is an extension of the ICED-ALE method to magnetohydrodynamic flow in three dimensions, is given. The properties of the method are discussed, including low computational diffusion, local conservation, and implicit formulation in the time variable. Also discussed are the problems encountered in applying boundary conditions and computing equilibria. The results of numerical computations of equilibria indicate that the

helical field amplitudes must be doubled from their design values to produce equilibrium in the Scyllac experiment. This is consistent with other theoretical and experimental results. ERA

N78-13903# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
MAJOR FEATURES OF D-T TOKAMAK FUSION REACTOR SYSTEMS Interim Report
J. W. Davis and G. L. Kulcinski (Wisconsin Univ., Madison) Feb. 1976 34 p refs
(EPRI-472-1) Avail: NTIS HC A03/MF A01

A set of tables were compiled to summarize and compare various designs of fusion-fission reactors based on the Tokamak configuration. The designs range from present-day experimental devices to conceptual commercial power units and are comprised of four near-term (approximately or less than 1985), five mid-term (approximately or less than 1990), and ten long-range (approximately 2000-2020) reactor designs. Besides the usual plasma physics parameters, individual tables characterize the reactor geometry and power plant system, the blanket and shield, the primary coolant systems, tritium breeding and inventory requirements, neutronics (including energy deposition and after heat), radiation damage, magnetic parameters, power cycles, and economic and resource requirements. ERA

N78-13904# Oak Ridge National Lab., Tenn.
DESIGN AND CONSTRUCTION OF A RESISTIVE ENERGY DUMP DEVICE FOR BIPOLAR SUPERCONDUCTING MAGNET SYSTEMS
Martin J. Mohan May 1977 38 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5892) Avail: NTIS HC A03/MF A01

Composed of an isolation switch, a semiconductor switching module, and a dump resistor, the resistive dump device provides a viable protection scheme. Operationally, several conditions are capable of activating the isolation switch and triggering the bipolar SCR switching module. Manual dump commands, for instance, permit the operator to dump field energy in the event of observed abnormalities. A special voltage tap quench detector senses the aforementioned abnormal power supply output inversion and also fires the dump circuit. Regardless of the nature of the trigger input, however, activation of the energy dump device diverts coil current through the dump resistor. I2R losses over time then safely dissipate stored magnetic field energy. ERA

N78-13905# Oak Ridge National Lab., Tenn.
MONTE CARLO ANALYSIS OF THE EFFECTS OF PENETRATION ON THE PERFORMANCE OF A TOKAMAK FUSION REACTOR
R. T. Santoro, J. S. Tang, R. G. Alsmiller, Jr., and J. M. Barnes 1977 10 p refs Presented at 5th Intern. Conf. on Reactor Shielding, Knoxville, Tenn., 18 Apr. 1977
(Contract W-7405-eng-26)
(CONF-770401-7) Avail: NTIS HC A02/MF A01

Adjoint Monte Carlo calculations were carried out to estimate the nuclear heating and radiation damage in the toroidal field (TF) coils adjacent to a 28 x 68 cm squared rectangular neutral beam injector duct that passes through the blanket and shield of a D-T burning Tokamak reactor. The plasma region, blanket, shield, and TF coils were represented in cylindrical geometry using the same dimensions and compositions as those of the Experimental Power Reactor. The radiation transport was accomplished using coupled 35-group neutron, 21-group gamma-ray cross sections and the nuclear heating and radiation damage were obtained using the latest available response functions. The presence of the neutral beam injector duct leads to increases in the nuclear heating rates in the TF coils ranging from a factor of 3 to a factor of 196 greater than in the fully shielded coils depending on the location. Substantial increases in the radiation damage were also noted. ERA

N78-13906# Princeton Univ., N. J. Plasma Physics Lab.
EFFECT OF DENSITY FLUCTUATIONS OF LOWER HYBRID RESONANCE CONE PROPAGATION
P. M. Bellan and K. L. Wong Apr. 1977 34 p refs
(Contract EY-76-C-02-3073)
(PPPL-1314) Avail: NTIS HC A03/MF A01

Experimental measurements show that coherent, azimuthal density fluctuations: (1) focus lower hybrid resonance cones azimuthally, and (2) modulate the radial location of the resonance cones. A simple theory based on wave refraction is presented; this theory is in good agreement with the experimental observations. The theory is extended to give a physical description of wave propagation through turbulent isotropic (perpendicular to B) noise such as was observed in Tokamaks; it is found that the turbulence causes the lower hybrid wave-vectors to have an angular spread in the plane perpendicular to B. ERA

N78-13907# Sandia Labs., Albuquerque, N. Mex.
ELECTRON-BEAM-FUSION Progress Report, Jul. - Sep. 1976
May 1977 80 p refs
(Contract EY-76-C-04-0789)
(SAND-76-0711) Avail: NTIS HC A05/MF A01

Discussions of research progress are given for the following areas: (1) PROTO 2 program, (2) power flow, (3) repetitively operated pulse generator development, (4) operations, (5) electron beam power from inductive storage, (6) fusion target design, (7) beam physics research, (8) power flow, (9) heavy ion fusion, (10) diode physics, (11) beam target interaction and target response studies, and (12) diagnostics development. ERA

N78-13908# Sandia Labs., Albuquerque, N. Mex.
THEORETICAL CONSIDERATIONS OF MAGNETIC CUSPS FOR ELECTRON-BEAM FUSION SYSTEMS
Thomas P. Wright Apr. 1977 34 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0593) Avail: NTIS HC A03/MF A01

A single particle motion of relativistic electrons in cusp magnetic fields has been studied analytically and numerically to evaluate some aspects of this approach to beam transport and trapping in inertial confinement schemes. It is found that angular momentum is a serious problem, and that at least one mirror loss cone exists for any initial injection conditions. Specular and randomizing reflections are investigated. It is found that charge and current neutral injection into a cusp will not provide good energy deposition for large aspect ratios (injection radius/target radius). Experimental results are analyzed using the information obtained from this theoretical study. The aspect ratio was small enough that angular momentum limits were not reached. ERA

N78-13909# Princeton Univ., N. J. Plasma Physics Lab.
CURRENT-DRIVEN INSTABILITIES AND RESULTANT ANOMALOUS EFFECTS IN ISOTHERMAL, INHOMOGENEOUS PLASMAS
M. Yamada and H. W. Hendel May 1977 72 p refs
(Contract EY-76-C-02-3073)
(MATT-1249) Avail: NTIS HC A04/MF A01

The evolution and effects of current-driven instabilities in isothermal, inhomogeneous plasmas are investigated in both theory and experiment. Successive destabilization of four different instabilities, low-frequency drift wave, ion-cyclotron drift wave, high-frequency (continuous-spectrum ion-cyclotron) drift wave, and high-frequency electron wave, are observed in Q-device plasmas with increased current, and explained by a theory based on fluid and kinetic equations. Anomalous effects resulting from wave-particle interactions, i.e., enhanced resistivity, ion heating and electron viscosity, are compared with predictions based on quasi-linear calculations. Analogous to ion sound causing important anomalies in the transport coefficients for plasmas with T/sub e//T/sub i/ much greater than 1, high-frequency, continuous-spectrum drift waves determine anomalous plasma behavior in inhomogeneous plasmas with T/sub e//T/sub i/ approximately equal to 1. ERA

N78-13910# Commission of the European Communities, Brussels (Belgium).
ROLE OF FUSION IN THE FUTURE OF NUCLEAR POWER. A EUROPEAN POINT OF VIEW
D. Palumbo and G. Grieger 1977 23 p In FRENCH Presented at Intern. Conf. on Nucl. Power and its Fuel Cycles, Salzburg, Austria, 2-13 May 1977, sponsored by IAEA
(IAEA-CN-36/473; Conf-770505) Avail: NTIS HC A02/MF A01

Fusion seems to offer specific advantages as an energy source

for Europe, including easy availability and widespread distribution of fuel, steady operation, high temperature operation allowing either for an increased thermal efficiency or for the delivery of process heat, probably less radioactive problems, and no proliferation problems. The European Fusion Programme is carried out as a joint coordinated enterprise of nine associated laboratories led by the Commission of the European Communities. It is strongly concentrated on toroidal magnetic confinement devices, in particular the Tokamaks. It is centered around the large proposed Tokamak experiment JET (Joint European Torus) whose operation is planned to start at the beginning of the next decade. This experiment aims at reaching plasma conditions close to the ones needed for a thermonuclear fusion reactor. If the results turn out to be positive, an experimental power reactor might be the next step. ERA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N78-13911 Georgetown Univ., Washington, D.C.
A LATTICE MODEL STUDY OF THE EFFECT OF FLEXIBILITY ON THE NEMATIC-ISOTROPIC TRANSITION IN PURE LIQUID CRYSTALS AND IN MIXTURES OF CHAIN SOLUTES IN LIQUID CRYSTAL SOLVENTS Ph.D. Thesis
Flonnie Dowell 1977 244 p
Avail: Univ. Microfilms Order No. 77-16847

Statistical mechanical, three-dimensional, mean field, simple cubic lattice models were used to study the effects of flexibility and attractive forces on the nematic-isotropic transition in homologous series of pure liquid crystals and in mixtures of nonmesomorphic chain solutes in liquid crystal solvents. The depression of the transition temperature of the pure solvent by a chain solute and the occurrence of a two phase region in the T star - x sub 2 (reduced temperature/mole fraction) plane are observed. Results of the steric models indicate that completely flexible molecules are too flexible to describe the qualitative behavior of real hydrocarbon chains; making the model chains semiflexible improves the qualitative comparison with experiment. Steric repulsive forces are found to be sufficient to generate the qualitative features of the transition in all models; however, the addition of attractive forces to semiflexible models results in better energetics and in some variations in trends. Dissert. Abstr.

N78-13912 Pennsylvania State Univ., University Park.
MICROSTRUCTURE, CRYSTALLOGRAPHY, AND CREEP OF DIRECTIONALLY SOLIDIFIED OXIDE EUTECTICS Ph.D. Thesis
William James Minford 1977 209 p
Avail: Univ. Microfilms Order No. 77-17712

The directional solidification of eutectic melts was investigated in CaZrO3-ZrO2, SrZrO3-ZrO2, MgO-MgAl2O4, MgO-ZrO2, MgO-CaO, Al2O3-ZrO2, and MgTi2O5-TiO2 to determine what parameters control the resultant structures. The creep properties of the MgO-MgAl2O4 directionally solidified eutectic with colony and grain structures and a nearly stoichiometric MgAl2O4 single crystal were investigated in four point bend. A true composite strengthening behavior was suggested in these materials because the creep resistance of the MgO-MgAl2O4 directionally solidified eutectic with a grain structure was greater than the matrix material, MgAl2O4, alone at 1600 C. Voids were prominent along the grain and colony boundaries in regions of the creep specimens which were subjected to tensile stress. Dissert. Abstr.

N78-13913 Princeton Univ., N. J.
ELECTRON BEAM INTERACTION WITH MOS CAPACITORS Ph.D. Thesis
Peter Roitman 1977 176 p
Avail: Univ. Microfilms Order No. 77-76898

The finely focused electron beam of several kilovolts energy generated in the scanning electron microscope was used in conjunction with induced current measurements and with high frequency and quasistatic capacitance measurements to study the interaction of an electron beam with the metal-silicon-oxide-silicon structure. A model for pair creation via plasmon decay followed by electron transport governed by a constant range is discussed, as well as current theories concerning the motion of holes. Interface state density increased linearly with radiation close in the oxide for low doses but saturated at a few times 1 million rads (SiO2). No systematic dependence on gate bias or irradiation-annealing history was observed. Dissert. Abstr.

N78-13914 Stanford Univ., Calif.
PREPARATION AND PROPERTIES OF SEMI-INSULATING LIQUID PHASE EPITAXIAL GALLIUM ARSENIDE FOR APPLICATION TO FET DEVICES Ph.D. Thesis
Yu-Min Houng 1977 112 p
Avail: Univ. Microfilms Order No. 77-18218

The optimum conditions for growing high resistance liquid phase epitaxial (LPE) layers in SiO2-C-He, SiO2-BC(C)-H2, and SiO2-BN-H2 systems and the transport related properties of these layers were determined. Chemical reactions in the systems studied were controlled by systematic bakeouts of the arsenic gallium melts before epitaxial growth. The dominant impurities were found to be silicon, carbon, and oxygen. The relative concentrations of the impurities were functions of bakeout temperature and were responsible for the conductivity type transition of the grown layers. Photoluminescence was measured in both chromium doped GaAs commercial substrates and in grown LPE layers. Thermal activation energies in the LPE layers were studied using van der Pauw techniques. Investigations of the interface properties of field effect transistors with and without LPE buffer layers revealed no detectable traps in the buffered devices. Dissert. Abstr.

N78-13915*# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.
PROPERTIES OF TiO2 THIN FILMS AND A STUDY OF THE TiO2-GaAs INTERFACE Final Report
Chung-Yih Chen and Michael A. Littlejohn Jun. 1977 99 p refs
(Grant NsG-1202)
(NASA-CR-155291) Avail: NTIS HC A05/MF A01 CSCL 20L

Titanium dioxide (TiO2) films prepared by chemical vapor deposition were investigated in this study for the purpose of the application in the GaAs metal-insulator-semiconductor field-effect transistor. The degree of crystallization increases with the deposition temperature. The current-voltage study, utilizing an Al-TiO2-Al MIM structure, reveals that the d-c conduction through the TiO2 film is dominated by the bulk-limited Poole-Frenkel emission mechanism. The dependence of the resistivity of the TiO2 films on the deposition environment is also shown. The results of the capacitance-voltage study indicate that an inversion layer in an n-type substrate can be achieved in the MIS capacitor if the TiO2 films are deposited at a temperature higher than 275 C. A process of low temperature deposition followed by the pattern definition and a higher temperature annealing is suggested for device fabrications. A model, based on the assumption that the surface state densities are continuously distributed in energy within the forbidden band gap, is proposed to interpret the lack of an inversion layer in the Al-TiO2-GaAs MIS structure with the TiO2 films deposited at 200 C. Author

N78-13916*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CRYSTAL FIELD AND MAGNETIC PROPERTIES
D. J. Flood 1977 12 p refs Presented at 23d Ann. Conf. on Magnetism and Magnetic Materials, Minneapolis, Minn., 8-11 Nov. 1977; sponsored by Am. Inst. of Physics and IEEE
(NASA-TM-73837; E-9330) Avail: NTIS HC A02/MF A01 CSCL 20B

Magnetization and magnetic susceptibility measurements have been made in the temperature range 1.3 to 4.2 K on powdered samples of ErH3. The susceptibility exhibits Curie-Weiss behavior from 4.2 to 2 K, and intercepts the negative temperature axis at theta = 1.05 + or - 0.05 K, indicating that the material is antiferromagnetic. The low field effective moment is 6.77 + or - 0.27 Bohr magnetons per ion. The magnetization exhibits a temperature independent contribution, the slope of which is (5 + or - 1.2) x 10 to the -6th Weber m/kg Tesla. The saturation moment is 3.84 + or - 1 - 0.15 Bohr magnetons

per ion. The results can be qualitatively explained by the effects of crystal fields on the magnetic ions. No definitive assignment of a crystal field ground state can be given, nor can a clear choice between cubically or hexagonally symmetric crystal fields be made. For hexagonal symmetry, the first excited state is estimated to be 86 to 100 K above the ground state. For cubic symmetry, the splitting is on the order of 160 to 180 K. Author

N78-13917*# National Aeronautics and Space Administration. Pasadena Office, Calif.
HIGH RESOLUTION THRESHOLD PHOTOELECTRON SPECTROSCOPY BY ELECTRON ATTACHMENT Patent Application
Ara Chutjian (JPL) and Joseph M. Ajello, inventors (to NASA) (JPL) Filed 30 Nov. 1977 13 p
(Contract NAS7-100)
(NASA-Case-NPO-14078-1; US-Patent-Appl-SN-856466) Avail: NTIS HC A02/MF A01 CSCL 20L

The stable energy levels of a species ion, of an atomic, molecular, or radical type are determined by application of a predetermined level of ionizing energy, such as through photoionization. A trapping gas is added to the gaseous species to provide a technique for detection of the energy levels. The electrons emitted from ionized species are captured by the trapping gas, only if the electrons have substantially zero kinetic energy. If the electrons have nearly zero energy, they are absorbed by the trapping gas to produce negative ions of the trapping gas that can be detected by a mass spectrometer. The light frequencies at which large quantities of trapping gas ions are detected are the stable energy levels of the positive ion of the species. SF6 and CFC13 have the narrowest acceptance bands, so that when they are used as the trapping gas, they bind electrons (to form negative ions) only when the electrons have very close to zero kinetic energy. NASA

N78-13918# Naval Avionics Facility, Indianapolis, Ind.
PERFORMANCE EVALUATION OF THIN LAYER THERMOELECTRIC DEVICE Final Report
William G. Kline 1 Sep. 1977 22 p
(AD-A045361; NAFI-TR-2195) Avail: NTIS HC A02/MF A01 CSCL 13/1

This report evaluates the performance characteristics of a thin layer thermoelectric device, developed for use in special cooling applications. Test results, conclusions, and recommendations are included. Author (GRA)

N78-13919# Effects Technology, Inc., Santa Barbara, Calif.
IMPACT DAMAGE IN SINGLE CRYSTALS Technical Report, 24 Mar. 1976 - 31 Jul. 1977
William F. Adler and Stephen V. Hooker 31 Jul. 1977 125 p refs
(Contract N00014-76-C-0744)
(AD-A045220; ETI-TR77-49) Avail: NTIS HC A06/MF A01 CSCL 20/2

Single crystals of calcium fluoride, silicon, and magnesium oxide were subjected to quasistatic bead indentations from very low to moderately high load levels as reference for the dynamic loading conditions. One mm diameter beads were used in all of the tests reported here. Sapphire beads were propelled at velocities up to 100 m/s using a modified air gun arrangement which allows accurate placement of the particle on the surface, measurement of the impact velocity, and eliminates any rotational motions which would normally be imparted to the particle. Nylon beads were propelled at velocities up to 1000 m/s using an exploding wire impact facility. Single water drop impacts can now be obtained on these crystals at velocities up to 500 m/s, and multiple water drop experiments are carried out in a rotating arm erosion facility at velocities up to 260 m/s. Preliminary observations of the damage produced by water drop impacts on CaF2, Si, and MgO are described for impact velocities below the coherent fracture threshold, but the effects of solid particle collisions on these crystals are considered in greater depth. Significantly different damage modes and sequences are observed for CaF2 and MgO subjected to quasistatic sapphire bead indentations, sapphire bead impacts, and nylon bead impacts. GRA

N78-13920# Naval Academy, Annapolis, Md.
DIELECTRIC RELAXATION IN RARE-EARTH DOPED CALCIUM FLUORIDE CRYSTALS Final Report, 1976 - 1977
Donald Joseph Link 23 May 1977 33 p refs
(AD-A045376; USNA-TSPR-88) Avail: NTIS HC A03/MF A01 CSCL 20/2

The study was made of the dielectric spectrum of calcium fluoride crystals with thirteen different rare-earth dopants. The paper describes the technical procedures of the experiment and results. The work was also done on computer. Five relaxations were observed which are characteristics of the series, with a possible sixth relaxation occurring at high temperatures. However, the main achievement of this project is the characterization of the dielectric spectrum for all rare-earth dopants. This characterization has laid the groundwork for a study on the effects of neutron irradiation of the crystals. The writer hopes that this will lead to the development of an improved dosimeter. Author (GRA)

N78-13921# Northwestern Univ., Evanston, Ill. Dept. of Mechanical Engineering and Astronautical Sciences.
A METAL CLUSTER GENERATOR FOR GAS PHASE ELECTRON DIFFRACTION AND ITS APPLICATION TO BISMUTH, LEAD AND INDIUM: VARIATION IN MICROCRYSTAL STRUCTURE WITH SIZE
Akimichi Yokozeki and Gilbert D. Stein Sep. 1977 38 p refs
(Contract N00014-76-C-0378; NR Proj. 092-544)
(AD-A045386; TR-3) Avail: NTIS HC A03/MF A01 CSCL 20/2

The objective of the work presented here is to determine the differences in structure of small metal microcrystals from that of the bulk phase as the average size is diminished. The size at which changes occur, as well as the nature of these changes, is of importance. The metal is vaporized in an oven in the presence of argon, an inert or carrier gas which initiates the metal nucleation and growth in the gas phase, near the evaporating surface. The newly formed microcrystals or clusters are entrained into a subsonic free jet and transported through a double orifice sampling arrangement. The portion of the argon-metal cluster mixture that passes through the second orifice or nozzle expands as a supersonic free jet and is crossed by a 40 kev electron beam 1 to 2 nozzle diameters downstream where diffraction patterns are taken on glass photographic plates. GRA

N78-13922# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
LUMINESCENCE AND HALL EFFECT OF ION IMPLANTED LAYERS IN ZnO Ph.D. Thesis. Final Report, Sep. 1970 - Sep. 1974
Bruce J. Pierce Oct. 1976 177 p refs
(AF Proj. 7367)
(AD-A045649; AFML-TR-75-161) Avail: NTIS HC A09/MF A01 CSCL 20/3

An experimental investigation was conducted on implanted layers of Li, Na, N, P, and Ne in ZnO substrates. The primary experimental method used was cathodoluminescence, and it was found that it was possible to probe an implanted layer by varying the beam voltage of the exciting electrons. A comparison of calculated implantation profiles with semi-quantitative electron profiles showed that fair agreement existed between these theoretical profiles and the depth-resolved cathodoluminescence results. The electrical properties of the implanted layers were obtained using the van der Pauw technique, and a photoluminescence system incorporating a nitrogen laser was used to perform time-resolved spectroscopy. Optical evidence of a shallow acceptor center in ZnO was revealed for the first time in the cathodoluminescent spectra obtained from implanted samples of ZnO, however, no evidence of type conversion and pn-junction formation was found in the electrical measurements. Cathodoluminescence was obtained over a temperature range of 10 to 300 K and the electrical properties were measured between 77 K and 373 K. Photoluminescence was recorded using sample temperatures in the range 4.2 to 300 K. Author (GRA)

N78-13923# Army Electronics Command, Fort Monmouth, N. J.
USE OF TRICHLOROETHYLENE FOR CHARGE CONTROL IN MOS OXIDES

Barbara Malley and Edwin R. Ahlstrom Aug. 1977 16 p refs (AD-A045714; ECOM-4518) Avail: NTIS HC A02/MF A01 CSCL 20/12

A fabrication facility for the preparation of Trichloroethylene/Oxide (TCE/O2) over the temperature range of 850 C - 1200 C is described. The TCE/02 oxide films obtained were of good quality, and uniform in the thickness range of 150-1500 angstrom. Electrical parameters such as Qss and Qo, were found to be at acceptable levels commensurate with values normally obtained in hydrochloric acid grown oxides or ultra-clean thermally grown oxides. Author (GRA)

N78-13924# Queens Univ., Belfast (Northern Ireland). Dept. of Applied Mathematics and Theoretical Physics.

A COMPARISON BETWEEN SEMICLASSICAL AND QUANTAL TREATMENTS OF ELASTIC E-H(IS) COLLISIONS AT INTERMEDIATE ENERGIES

R. H. G. Reid, A. E. Kingston, and M. J. Jamieson 5 Oct. 1976 8 p refs

(Contract N00014-69-C-0035; Grant N00014-77-G-0001)

(AD-A045855) Avail: NTIS HC A02/MF A01 CSCL 20/8

Differential elastic cross sections for e-H(1s) collisions at impact energies between 30 eV and 200 eV have been calculated by semiclassical and quantal methods. Both methods are 1s-2s-2p close-coupled with exchange neglected, and so differ only in the collision treatment. The discrepancy between the semiclassical and quantal results increases as scattering angle Theta increases and decreases as impact energy increases. At 30 eV, the discrepancy lies between 6% (at Theta = 0 deg) and 60% (at Theta = 180 deg). At 200 eV, the corresponding figures are 4% and 28%. However, the semiclassical results are inferior to the first Born approximation when the momentum transfer exceeds about 0.5 au. Author (GRA)

N78-13925# Cornell Univ., Ithaca, N. Y.

LOW ENERGY PLANES FOR TILT GRAIN BOUNDARIES IN GOLD

P. J. Goodhew, T. Y. Tan, and R. W. Balluffi May 1977 30 p

(Contract EY-76-S-02-2679)

(COO-2679-13) Avail: NTIS HC A03/MF A01

Thin film bicrystals of gold were annealed to create a large variety of grain boundaries of controlled crystal misorientation. The faceting of these boundaries was studied, and some low-energy boundary planes were identified. Tilt boundaries with a (100) misorientation axis were found to facet more readily than those with a (100) axis. The results were considered in terms of O-lattices and coincident site lattices, but neither of these approaches is able to explain all the observations. Consequently, no simple and general criteria, based on geometrical considerations, were found for the occurrence of grain boundary planes of low energy. A further set of observations relates to the dissociation of some specific high-angle grain boundaries into a twin and another low-energy boundary. Boundaries with a sigma 33 coincidence site lattice relationship frequently appear to be characterized by a relatively low energy. ERA

N78-13926# Brown Univ., Providence, R. I. Div. of Engineering.

STRAIN LOCALIZATION IN DUCTILE SINGLE CRYSTALS

R. J. Asaro and James R. Rice Apr. 1977 63 p refs

(Contract EY-76-S-02-3084)

(COO-3084-49; TR-49) Avail: NTIS HC A04/MF A01

Strain localization in ductile crystals deforming by single slip was analyzed. The plastic flow was modeled as rate-in-sensitive; and localization, viewed as a bifurcation from a homogeneous deformation mode to one which is concentrated in a narrow shear band, was found to be possible only when the plastic hardening modulus for the slip system has fallen to a certain critical value. It is suggested that micromechanical processes such as cross-slip in crystals provide specific cases for which stresses may influence plastic response and, further, there is an experimental association of localization with the onset of large amounts of cross-slip. ERA

N78-13927# Cornell Univ., Ithaca, N. Y. Dept. of Materials Science and Engineering.

MIGRATION OF TILT BOUNDARIES AND FACET DEVELOPMENT IN THIN GOLD BICRYSTALS

R. M. Allen and P. J. Goodhew Apr. 1977 34 p refs

(Contract EY-76-S-02-2679)

(COO-2679-11; Rept-2826) Avail: NTIS HC A03/MF A01

Thin films of gold were welded together to create bicrystals containing (001) twist grain boundaries. The bicrystals were heated in the transmission electron microscope, and the migration of first twist and subsequently tilt regions of the boundary was observed directly. The tilt boundaries showed a tendency to facet which grew less pronounced as the twist angle was increased. The preferred boundary planes appeared to be controlled either by inhomogeneities in the thickness of the original single-crystal films or by the lowest-energy section of the O-lattice, which in this case is the plane with the highest density of O-points. The interaction of a migrating boundary with bubbles of a range of sizes was also observed, and the pinning effects are reported. ERA

N78-13928# California Univ., Berkeley. Lawrence Berkeley Lab.

ANALYSES OF GRAIN BOUNDARY REACTIONS IN ALUMINUM-ZINC ALLOYS UTILIZING LATTICE IMAGING ELECTRON MICROSCOPY Ph.D. Thesis

Ronald Gronsky Dec. 1976 149 p refs

(Contract W-7405-eng-48)

(LBL-5784) Avail: NTIS HC A07/MF A01

Lattice imaging and conventional transmission electron microscopy were applied in an investigation of the relationship between grain boundary structure and boundary-nucleated phase transformations. The study encompassed three reactions associated with grain boundaries in the Al-Zn system: heterogeneous nucleation at grain boundaries, discontinuous precipitation involving the R-phase and the low temperature discontinuous reaction. In conjunction with image computations, lattice images were interpreted using direct fringe spacing measurements, microdensitometer traces and optical diffraction, providing superior capabilities in structural and chemical analysis. Errors of less than or equal to 1% were achieved by only 10-fringe samplings using an internal magnification standard. ERA

N78-13929# Sandia Labs., Albuquerque, N. Mex.

NORMAL MODE RESPONSES OF LINEAR PIEZOELECTRIC MATERIALS WITH HEXAGONAL SYMMETRY

Peter J. Chen and Stephen T. Montgomery 1977 22 p refs Presented at 15th Midwestern Mech. Conf., Chicago, 23 Mar. 1977

(Contract E(29-1)-789)

(SAND-76-9062; Conf-770306-1) Avail: NTIS HC A03/MF A01

The dynamic coupled electromechanical responses of linear piezoelectric materials which have the symmetry of a hexagonal crystal in class C/sub 6v/ are considered. Such a material has five independent elastic constants, three independent piezoelectric constants, and two independent dielectric constants. ERA

N78-13930# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.

EFFECTS OF TEMPERATURE AND IMPURITIES ON THE ATOMIC DISPLACEMENT ENERGY DURING ELECTRON IRRADIATION M.S. Thesis

Robert Michael Drosd Jun. 1977 65 p refs

(Contract W-7405-eng-48)

(LBL-6075) Avail: NTIS HC A04/MF A01

The threshold energy for Frenkel pair production (E/sub d/) is a parameter of importance when theoretical calculations of displacement damage rates are needed to predict long term radiation effects in materials. Hence it is desirable to understand how the threshold energy may be affected by important environmental factors such as temperature and impurities. Copper and Cu-Al alloys were studied as model pure metal and metal-impurity systems. Irradiations were performed in a high voltage electron microscope from room temperature up to 300 C. Impurities lighter than the solvent atoms were found to lower the critical value of electron accelerating voltage required to cause atomic displacement. Increasing the temperature in the range of room temperature to 300 C caused a decrease in E/sub d/from 18 to 12 eV. Thermally activated escape from mutual annihilation of closely spaced vacancies and interstitials is thought to be responsible for this effect resulting in a 300

percent increase in the displacement rate during 650 keV electron irradiation. ERA

N78-13931# Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).
SEMICONDUCTING SUBSTRATE FOR FET AND INTEGRATION ON SEMICONDUCTING GaAs Final Report [ETUDE DE SUBSTRAT SEMI-ISOLANT POUR FET ET INTEGRATION GaAs]
Oct. 1976 38 p refs In FRENCH Prepared jointly with Radiotech. S.A., Caen, France
(Contracts DGRST-75-7-664; DGRST-75-7-665)
(LEP-76/1155.SME-645-A) Avail: NTIS HC A03/MF A01

The horizontal Bridgman crystal growing technique was applied to GaAs with a view to improving the purity of undoped GaAs and with regard to the crucible material nature. Doping by Cr and Cr+O yielded semiconductors. The influence of the growth parameters was correlated to electrical properties, crystallographic quality, thermal stability using various methods including Hall effect, metallography, photoluminescence, and TSC. It was shown that there was a contradiction between requirements for the best material as seen from the electrical quality or metallurgical quality aspects. A correlation was found between defect density number, dopant nature, and FET performance. ESA

N78-13932# Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).
SEARCH FOR NEW GROWTH CONDITIONS AT LOW TEMPERATURES: APPLICATION TO GALLIUM ARSENIDE Final Report [RECHERCHE DE NOUVELLES CONDITIONS DE CROISSANCE A BASSE TEMPERATURE: APPLICATION A L'ARSENIURE DE GALLIUM]
Dec. 1976 88 p refs Partly in FRENCH and partly in ENGLISH
(Contract DGRST-75-7-1489)
(LEP-77/172.SME-441-G) Avail: NTIS HC A05/MF A01

A study of the parameters which must be controlled to allow vapor growth of GaAs at low temperature (LT.VPE) using the AsCl3-GaAs-H2 system has led to routine growth of MESFET layers at 630 C. The source temperature was determined from transport efficiency measurements and studied in the 670 to 680 C range. The growth rate dependence on temperatures and AsCl3 mole fraction were determined. The morphology of the layer was optimized as a function of the AsCl3 mole fraction and the misorientation of the substrate (about 6 deg off from (001)). These growth conditions were applied to submicron layer growth and MESFET devices were fabricated. A comparison of the device performances obtained on layers deposited at high (750 C) and low (630 C) temperatures shows an improvement on unbuffered layers grown at low temperature. Furthermore, the growth of an n(-) buffer layer at low temperature improves still further the noise figure. Typical results without buffer layers, at 10 GHz, are 4 db NF, 7.5 db associated gain, and 11 db maximum gain. Author (ESA)

N78-13933# Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).
ELECTRONIC PROPERTIES, ABUNDANCE AND ORIGIN OF DEEP LEVELS IN EPITAXIALLY GROWN GALLIUM ARSENIDE Final Report [PROPRIETES ELECTRONIQUES, ABONDANCE ET ORIGINE DES NIVEAUX PROFONDS DANS L'ARSENIURE DE GALLIUM OBTENU PAR CROISSANCE EPITAXIALE]
A. Mircea, A. Mitonneau, G. M. Martin, and G. Laurence Dec. 1976 77 p refs Partly in FRENCH and partly in ENGLISH
(Contract DGRST-75-7-1484)
(LEP-77/178.SME-440-D) Avail: NTIS HC A05/MF A01

An analysis using deep level transient spectroscopy was performed on GaAs in various epitaxy configurations (vapor and liquid phases or molecular jets). A rather complete characterization was possible for some of the deep levels in the forbidden bands with emphasis on free carrier absorption cross sections and photon absorption cross sections as a function of temperature. The results were compared with other characterization methods. The discrete levels introduced by artificially introducing Cu impurities were studied in detail. Thermal treatments in the absence of such impurities lead to results interpretable as exodiffusion. An empirical relationship between crystal growth conditions and the existence of deep levels is proposed. ESA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N78-13934 Cornell Univ., Ithaca, N. Y.
ANALYSIS OF HIGH ENERGY BEHAVIOR IN QUANTUM FIELD THEORY: A RENORMALIZATION-GROUP METHOD Ph.D. Thesis
Allen Maury Carroll 1976 97 p
Avail: Univ. Microfilms Order No. 77-19990

Integration over energy fluctuations of successively smaller size, and the computation of effective Hamiltonians which reflect the effects of the fluctuations which have been integrated out are included in a renormalization group method used in qualitative analyses of high-energy small-angle scattering. Model field theories based on scalar cu phi theory and quantum electrodynamics (QED) are described, and details of the integration procedure are discussed in the context of these model systems. Simple recursion relations which sum the logarithms associated with ladder graphs in cu phi theory and with tower graphs in QED are demonstrated. The recursion relations for QED are shown to generate an infinite set of marginal interactions, all of which accumulate logarithms; the existence of these marginal interactions accounts for the complexity of previous analyses of high-energy scattering. Dissert. Abstr.

N78-13935# California Univ., Berkeley. Lawrence Berkeley Lab.
DOUBLE QUANTUM NMR IN SOLIDS
A. Pines, S. Vega, D. J. Ruben, T. W. Shattuck, and D. E. Wemmer Jan. 1977 54 p refs
(Contract W-7405-eng-48)
(LBL-6040) Avail: NTIS HC A04/MF A01

The operator theory of double quantum nuclear magnetic resonance is presented. The determination of high resolution spin-1 NMR in dimethylsulfoxide and in 99% deuterated ice at -90 C is demonstrated. A.R.H.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N78-13936# Joint Publications Research Service, Arlington, Va.
REFERENCE AID GLOSSARY OF ACRONYMS, ABBREVIATIONS, AND SPECIAL TERMS USED IN THE WESTERN EUROPE ROMANCE-LANGUAGE PRESS
25 Nov. 1977 196 p Transl. into ENGLISH from Selected Foreign Periodicals (France)
(JPRS-70222) Avail: NTIS HC A09/MF A01

A selective list is given of acronyms, abbreviations, and special terms found in the Western Europe Romance-language press. Author

N78-13937# Joint Publications Research Service, Arlington, Va.
REFERENCE AID GLOSSARY OF ACRONYMS, ABBREVIATIONS, AND SPECIAL TERMS USED IN DUTCH, FINNISH, GERMAN (WESTERN EUROPE), AND SCANDINAVIAN PRESS
25 Nov. 1977 83 p Transl. into ENGLISH from Selected Foreign Periodicals (W. Germany)
(JPRS-70223) Avail: NTIS HC A05/MF A01

This is a selective list of acronyms, abbreviations, and special terms found in the Dutch, German-language (Western Europe), and Scandinavian press. Author

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N78-13938*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THE MINE PROJECT: MINORITY INVOLVEMENT IN NASA ENGINEERING

Harrison Allen, Jr. 1977 8 p Presented at 49th Ann. Meeting of the Natl. Technical Assoc., Inc., Hampton, Va., 2-5 Aug. 1977

(NASA-TM-73811; E-9397) Avail: NTIS HC A02/MF A01 CSCL 05A

The Mine Project developed by Lewis Research Center (LRC) along with Tennessee State University and Tuskegee Institute, is described. The project calls for LRC to assemble on-going NASA university affairs programs aimed at benefiting the school, its faculty, and its student body. The schools receive grants to pursue research and technology projects that are relevant to NASA's missions. Upon request from the universities, LRC furnishes instructors and lecturers. The schools have use of surplus government equipment and access to NASA research facilities for certain projects. Both the faculty and students of the universities are eligible for summer employment at LRC through special programs. The MINE Project is designed to establish a continuing active relationship of 3 to 5 years between NASA and the universities, and will afford LRC with an opportunity to increase its recruitment of minority and women employees.

Author

N78-13939# Perceptronics, Inc., Woodland Hills, Calif.

AN INTERACTIVE COMPUTER AIDING SYSTEM FOR GROUP DECISION MAKING

Steven Levin, Antonio Leal, Judea Pearl, and Joseph Saleh 1 Sep. 1977 119 p

(Contracts MDA903-77-C-0184; ARPA Order 3344)

(AD-A045329; PQTR-1046-77-9) Avail: NTIS HC A06/MF A01 CSCL 09/2

This report describes progress on work centered on the demonstration of an interactive computer aid for group decision making. The report includes; (1) a new sensitivity algorithm for decision tree analysis that incorporates information about individual differences in judgmental knowledge, (2) procedures for identifying and resolving utility conflicts, (3) a refined version of the group/machine and intermediator/machine interface and displays, (4) a preliminary problem scenario booklet to be used in the system's empirical evaluations, and (5) a report on the project's software development efforts. The next phase of the program will concentrate on the system's implementation, operational testing, and initial evaluation. Author (GRA)

N78-13940# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.

INFORMATION AND SIGNALING IN DECENTRALIZED DECISION PROBLEMS

Marcia P. Kastner Sep. 1977 137 p refs

(Contracts N00014-75-C-0648; NSF ENG-76-11824)

(AD-A045111; TR-669) Avail: NTIS HC A07/MF A01 CSCL 12/2

A decentralized many-person decision problem is one where each decision maker has different information. If one decision maker's information depends on what another decision maker has done, the information is called dynamic. In the past, problems involving dynamic information have been very difficult, if not impossible, to solve. Two specific examples which have been solved, one from economic theory and the other from classical information theory, will be investigated. It will be shown that they can be formulated as two-person decision problems with the type of dynamic information structure called signaling. The first example involves a model of the job market as a nonzero-sum game. New equilibrium solutions are found and properties of these solutions, such as stability, multiple solutions, and threshold effects of signaling cost and noise, are studied. The second example models the Shannon problem as a team theory problem. The concept of real-time information theory is introduced, where source and channel sequences are of a fixed length, and general results about real-time solutions are proved and demonstrated.

Author (GRA)

N78-13941# General Accounting Office, Washington, D. C. Procurement and Systems Acquisition Div.

SHARING THE DEFENSE BURDEN: THE MULTINATIONAL F-16 AIRCRAFT PROGRAM

15 Aug. 1977 46 p

(PB-271251/1; PSAD-77-40) Avail: NTIS HC A03/MF A01 CSCL 05A

Progress made in implementing the F-16 multinational aircraft program is discussed. In view of the complexity of the F-16 multinational program, and the inherent problems in any European coproduction, it is to be expected that a variety of critical issues will surface as the program matures. The current most critical issues which could have an impact on the program are described as well as the relationship established between the United States and the European Participating Governments. GRA

N78-13942# Health Effects Research Lab., Research Triangle Park, N. C. Criteria and Special Studies Office.

MANAGEMENT POLICY FOR THE ASSURANCE OF RESEARCH QUALITY, HEALTH EFFECTS RESEARCH LABORATORY, RESEARCH TRIANGLE PARK, NORTH CARCLINA

Jun. 1977 34 p refs

(PB-270978/0; EPA-600/1-77-036) Avail: NTIS HC A03/MF A01 CSCL 05A

Policies, goals, and an organizational structure for the implementation of a management policy are presented. Directed toward functional managers, a system for quality assurance monitoring of task quality control functions is described. General areas affecting data quality are discussed from the perspective of the manager as a reviewer of documents or plans. The application of quality assurance measures is the responsibility of taskmasters or project officers. It is the responsibility of functional management to ensure that all project-oriented documents or plans have incorporated appropriate quality assurance procedures. GRA

N78-13943# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

THE DIMENSIONALITY AND EFFECTIVENESS OF INFLUENCE METHODS USED IN A MATRIX ORGANIZATIONAL ENVIRONMENT M.S. Thesis

Richard C. Leclaire Sep. 1977 103 p refs

(AD-A045878; AFIT-GSM/SM/77S-10) Avail: NTIS HC A06/MF A01 CSCL 12/2

The matrix organization generate authority ambiguity whereby there is multiple supervision of project personnel. Further, the project manager has much less authority than responsibility. To compensate for this, a variety of influence methods are used. The purpose of this study is to investigate the independence and the effectiveness of the influence methods used by project and functional managers in the matrix organizational environment. To accomplish this, 264 personnel answered a questionnaire. These personnel were in six different System Program Offices at Wright-Patterson Air Force Base. The questionnaire dealt with six different effectiveness variables and ten influence methods, and the responses were subjected to a statistically based multivariate analysis. GRA

N78-13944# Harvard Univ., Cambridge, Mass.

STATUS OF RISK-BENEFIT ANALYSIS

A. J. VanHorn and R. Wilson Dec. 1976 31 p refs

(Contract EY-76-C-02-0016)

(BNL-22282) Avail: NTIS HC A03/MF A01

The benefits and deficiencies of cost benefit analysis are reviewed. It is pointed out that, if decision making involving risks and benefits is to improve, more attention must be paid to the clear presentations of the assumptions, values, and results. Reports need to present concise summaries which convey the uncertainties and limitations of the analysis in addition to the matrix of costs, risks, and benefits. As the field of risk-benefit analysis advances the estimation of risks and benefits will become more precise and implicit valuations will be made more explicit. Corresponding improvements must also be made to enhance

communications between the risk-benefit analyst and the accountable decision maker. ERA

N78-13945# Los Alamos Scientific Lab., N. Mex.
SOVIET EQUATION OF STATE RESEARCH IN 1970 - 1975
W. H. Weihofen Apr. 1977 38 p refs
(Contract W-7405-eng-36)
(LA-6692) Avail: NTIS HC A03/MF A01

Equation-Of-State (EOS) research performed in the Soviet Union as reported in the open literature from 1970 to 1975 is analyzed. The work is discussed by institution and group, and attention is given to the intensity and type of research as well as the materials of interest. The appendixes list the substances whose EOS have been studied, the institutions where the research was done, and the authors of the research papers, all referenced to the extensive bibliography. 235 references. ERA

N78-13946# Bridgeport Univ., Conn.
INITIAL IMPLEMENTATION FOR A DATA MANAGEMENT SYSTEM Final Report
Stanley Schenkerman 1 Feb. 1977 109 p refs Prepared for League of Cities-Conf. of Mayors, Inc., Washington, D. C. and Higher Educ. Center for Urban Studies, Bridgeport, Conn.
(Contract HUD-H-2196R)
(PB-270717/2; UO-LCCM-BRI-77-008; HUD-RES-1115) Avail: NTIS HC A06/MF A01 CSCL 05B

The initial phases of the design and development of a data management system for the city of Bridgeport were conducted. The work had to be performed with minimal use of the city's computer resources and minimal encroachment on the data processing staff's time. The project brought the data base and corresponding application programs design and coding to the ready-for-debug state. This state is the starting point for the next phase, the follow-on project which has already been planned and scheduled. GRA

N78-13947# Research Corp. of New England, Wethersfield, Conn.
RANKING THE INPUT AND OUTPUT DATA USED TO DETERMINE NEW SOURCE PERFORMANCE STANDARD IMPACTS Final Report, Jul. 1974 - Jul. 1976
Thomas G. Hopper and William A. Marrone Apr. 1977 168 p refs
(Contract EPA-68-02-1382)
(PB-271329/5; EPA-450/3-76-019a) Avail: NTIS HC A08/MF A01 CSCL 13B

The impact of new source performance standards on nationwide emissions was studied. The results are used by EPA as input to the development of an overall standard setting strategy. Controlled and uncontrolled emission factors, State emission limitations, industrial capacity, utilization, growth and retirement rates are among the factors examined. GRA

N78-13948# National Science Foundation, Washington, D. C.
PERCEPTIONS OF THE NATIONAL SCIENCE FOUNDATION PEER REVIEW PROCESS: A REPORT ON A SURVEY OF NSF REVIEWERS AND APPLICANTS Final Report, 1975 - 1976
Deborah R. Hensler Dec. 1976 135 p refs Prepared for Comm. on Sci. and Technol. (U.S. House)
(PB-271775/9; NSF-77-33) Avail: NTIS HC A07/MF A01 CSCL 05A

Mail surveys were conducted: one directed to NSF reviewers and the other to recent applicants for NSF funds. Questionnaires were designed to elicit information from these researchers about their experiences with the NSF review process, their evaluations of review procedures, and their attitudes toward various modifications in the review process which were under discussion in the scientific community. An analysis of responses which focused on three major questions is included. GRA

N78-13949# Colorado State Univ., Fort Collins.
ORGANIZATION AND PERSONNEL MANAGEMENT FOR EFFECTIVE INTERDISCIPLINARY RESEARCH Final Report, 1 Sep. 1974 - 28 Feb. 1977
Douglas A. Benton, James R. Meiman, Daryl B. Simons, Douglas D. Sjogren, and Donald C. Taylor Feb. 1977 349 p refs
(Grants NSF RMI-74-22728; NSF NM-44411)
(PB-271796/5) Avail: NTIS HC A15/MF A01 CSCL 05A

The objectives of this project were to: (1) develop a workable evaluation system for large-scale interdisciplinary research (LSIDR) projects, and (2) investigate the linkages between effectiveness and management characteristics of these large-scale projects. A case study approach was used on six large-scale projects within Colorado State University. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N78-13950# Economic Research Service, Washington, D. C.
VIEWING KNOWLEDGE AS A RESOURCE IN FEDERAL DEPARTMENTS OF THE U.S. GOVERNMENT Final Report
James F. Berry and Craig M. Cook Sep. 1977 129 p refs
(PB-271925/0; AGERS-41) Avail: NTIS HC A07/MF A01 CSCL 05B

Knowledge (as opposed to data or information) is proposed as a basic resource of departments of the Federal Government. A theory of knowledge is presented as a foundation for many of the concepts involved with establishing a knowledge resource for a department. This theory provides a framework and a vocabulary for the subsequent discussion on implementation. Various types of technology which might be useful in building and using a knowledge resource are explored. Finally a model of a people/machine system which can be used to support a knowledge resource is proposed. In an appendix, potential problems in the construction and use of a knowledge resource are listed, and several areas where further research and development are needed are discussed. GRA

N78-13951# Battelle Pacific Northwest Labs., Richland, Wash.
COMPREHENSIVE INFORMATION RETRIEVAL AND MODEL INPUT SEQUENCE (CIRMIS)
D. R. Friedrichs Apr. 1977 82 p ref
(Contract EY-76-C-06-1830)
(BNWL-2235) Avail: NTIS HC A05/MF A01

A computer system developed to increase data storage and retrieval capabilities and ground-water model control is described. The overall configuration, however, can be used in other areas to provide the user with three major functions: retrieval of well-based data, special application for manipulating surface data or background maps, and the manipulation and control of ground-water models. These programs comprise only a portion of the entire comprehensive information retrieval and model input sequence system. ERA

N78-13952# National Library of Medicine, Bethesda, Md. Bibliographic Services Div.
MEDICAL SUBJECT HEADINGS: TREE ANNOTATIONS, 1978. MEDLARS INDEXING INSTRUCTIONS
Thelma Charen Aug. 1977 123 p Revised
(PB-271246/1; NLM-MED-77-04) Avail: NTIS HC A06/MF A01 CSCL 05B

This manual, designed for medical indexers and searchers, has a two fold purpose: first, to give a general statement on the approach an indexer or searcher should pursue to a given tree, and second, to advise him of special features within that tree that he should be aware of before indexing or searching. GRA

N78-13953# W/V Associates, Landover, Md.
IDENTIFICATION AND PREPARATION OF DERIVATIVE INFORMATION PRODUCTS REQUIRED BY SELECTED USERS OF SCIENCE INFORMATION Final Technical Report, Oct. 1974 - Oct. 1976
Anne S. Mavor, W. S. Vaughan, Jr., and J. S. Kidd Jan. 1977 137 p Prepared for Maryland Univ., College Park
(Grant NSF SIS-74-14127)

(PB-270631/5) Avail: NTIS HC A07/MF A01 CSCL 05B

The effectiveness of computer-based systems in providing knowledge required by users, rather than citations to documents was studied. The outputs of future systems are assumed to be derivative information products whose content and format characteristics match the specific need characteristics of the individual user. Main categories of derivative information product needs were identified through structured interviews with fourteen researchers and twelve teachers active in the field of environmental science. Product design criteria for individual users were delineated in case study fashion, working in an on-line mode with two researchers and two teachers to develop specific derivative information products in response to their current work requirements. Products of great utility were prepared by relatively inexperienced information specialists using a successive screening process conducted according to the requirements protocol set-up from the task-oriented interview findings. Author

N78-13954# Forecasting International Ltd., Arlington, Va.
POTENTIAL IMPACTS OF AUTOMATION AND USER FEES UPON TECHNICAL LIBRARIES Final Report
Audrey Clayton and Norman Nisenoff 30 Jun. 1977 185 p
(Grant NSF ERP-75-09118)
(PB-271418/6; NSF/RA-770163) Avail: NTIS HC A09/MF A01 CSCL 05B

The impacts are studied of the introduction in technical libraries of some degree of automated data processing, and/or their adoption of a fee for service policy. Because of the primary interest of the sponsor in scientific and technical information (STI) transfer, the effort has concentrated upon libraries which form a link in the chain of STI dissemination, especially for research purposes. Both positive and negative impacts are considered, as they may concern various levels of societal units, from the individual library user or employee, to the administrative, institutional, regional or national entities whose roles are affected in consequence. The study attempts to combine an overall discussion of broad consequences of automation or charging in research libraries, with narrowly focused examples of the impact of specific instances of such innovations. GRA

N78-13955# Mathtech, Inc., Princeton, N. J.
AN EVALUATION OF THE SCIENCE INFORMATION ACTIVITIES OF THE NATIONAL SCIENCE FOUNDATION, 1950 - 1973 Final Report
Ernest H. Manuel, Jr., Robert J. Anderson, and Faye Duchin
1 Aug. 1977 524 p refs
(Contract NSF C-1023)
(PB-271523/3) Avail: NTIS HC A22/MF A01 CSCL 05B

Over 2,000 awards in the amount of $155 million were grouped into four major categories, namely, publications and translations, information systems, research and studies, and information centers. Analyses and conclusions were developed separately for each of the four major activity categories. GRA

N78-13956# Advisory Group for Aerospace Research and Development, Paris (France).
AGARD INDEX OF PUBLICATIONS, 1974 - 1976
Oct. 1977 401 p
(AGARD-index-74-76) Avail: NTIS HC A18/MF A01

Full bibliographic citations and abstracts for all the documents are given in the abstract section, which is organized in the 10 major subject divisions and 74 specific categories used by NASA in its abstract journals and bibliographies. The major subject divisions are listed in the Table of Contents, together with a note for each that defines its scope and provides any cross references. Category breaks in the abstract section are identified by category number and title and a scope note. Within each category, the abstracts are arranged by series and year. N10,000 series (STAR) items appear before X70,000 series items. Examples of typical citations with abstracts are given following the Table of Contents. Author

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N78-13957*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BALTIMORE APPLICATIONS PROJECT Annual Progress Report
Tom Golden Jun. 1977 31 p refs
(NASA-TM-78021; APR-3) Avail: NTIS HC A03/MF A01 CSCL 05A

The program to assist the City of Baltimore with technology of all types has completed its third year of operation. Some 43 task areas are discussed; the task identification is essentially complete. Author

N78-13958# Rose-Hulman Inst. of Tech., Terre Haute, Ind. Dept. of Chemical Engineering.
THE EFFECT OF POLYACRYLAMIDE MOLECULAR STRUCTURE ON FLOCCULATION ACTIVITY OF DOMESTIC SEWAGE Final Report
Jerry A. Caskey Jul. 1977 115 p
(Grant NSF GK-43989)
(PB-271016/8) Avail: NTIS HC A06/MF A01 CSCL 13B

Polyacrylamides have been shown to be effective flocculants in domestic waste treatment plants. The effectiveness of branches as opposed to linear anionic polyacrylamides at various hydrolysis and molecular weight levels was studied. Tests results indicate that: (1) a linear structure is more effective than a branched structure, (2) increasing molecular weights increases the flocculation effectiveness of the polymer for both linear and branched polymers within the molecular weight range studied, (3) slurry pH should not be acidic (below 6.5) for effective bridging to occur, (4) the polymer should be hydrolyzed in the range of 15-30% for optimum effectiveness. GRA

N78-13959# Urban Systems Research and Engineering, Inc., Cambridge, Mass.
CLASSIFICATION OF AMERICAN CITIES FOR CASE STUDY ANALYSIS, VOLUME 1. SUMMARY REPORT Final Report
Elizabeth Lake, Carol Blair, James Hudson, and Richard Tabors
May 1977 50 p
(Contract EPA-68-01-3299)
(PB-271021/8; EPA-600/5-77-008a-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 13B

This methodology for the systematic selection of representative case study metropolitan areas begins with a data base on

standard metropolitan statistical areas, including variables related to environmental quality, urban form, and household, industrial, and government activity. It analyzes these variables through a two-stage factor analysis technique which allows heuristic consideration of the significant characteristics. Finally, it develops city clusters which group areas with similar attributes. Representative cities are selected for each group and suggested as case study sites. These groups may be used to generalize the study results and to analyze the transferability of results between areas. The methodology is sufficiently flexible to consider a wide range of research hypotheses. GRA

N78-13960# Colorado State Univ., Fort Collins.
ON-LAND DISPOSAL OF MUNICIPAL SEWAGE SLUDGE: A GUIDE TO PROJECT DEVELOPMENT Interim Report
M. H. Lutkin, J. L. Smith, and D. B. McWhorter Jul. 1977 145 p refs
(Grant NSF AEN-74-08082)
(PB-271144/8; NSF/RA-770165) Avail: NTIS HC A07/MF A01 CSCL 13B

Computerized simulation of a hypothetical project is used to demonstrate to designers or administrators a procedure for bringing to fruition a proposed land application facility for municipal sewage sludge. Subjects discussed include permits and approval processes; pathogenic microorganisms; inorganic and organic contaminants; surface conditions that can be expected at a field location; a cursory discussion of anticipated subsurface conditions including groundwater and soil-water movement, soil properties, and procedures for obtaining data; and the effect of sludge application and climate on operation. GRA

N78-13961# Illinois Univ., Chicago. Urban Systems Lab.
METHODOLOGY FOR IDENTIFYING URBAN TRANSPORTATION TECHNOLOGY ALTERNATIVES Final Report, Jun. 1975 - Mar. 1977
Edward W. Walbridge Mar. 1977 30 p refs
(PB-271225/5; UMTA-IL-11-0008-77-2) Avail: NTIS HC A03/MF A01 CSCL 13B

An information system is described which accepts as input a set of characteristics describing a particular transportation need and yields as output a list of transportation technologies capable of satisfying the need. A broad range of transportation need situations can be fed into this system. The system, however, is concerned with people movement rather than goods movement. The user of the system specifies the nature and extent of demand, as well as certain service requirements. A transportation technology is identified as suited to a particular need situation when the technology meets the demand and the service requirements, and does so at reasonable costs. The system consists of two tables. Their use is described and examples are presented. The procedure used to develop the tables is discussed. GRA

N78-13962# Transportation Systems Center, Cambridge, Mass.
EXPERIMENTS OF FOUR DIFFERENT TECHNIQUES FOR AUTOMATICALLY LOCATING LAND VEHICLES, A SUMMARY OF RESULTS Final Report, 1976 - 1977
Bernard E. Blood, W. A. Bernd, and A. Kleim Jun. 1977 51 p refs
(PB-270951/7; DOT-TSC-UMTA-77-28;
UMTA-MA-06-0041-77-2) Avail: NTIS HC A04/MF A01 CSCL 13F

Technical methods for automatically locating surface vehicles were tested in both high and low-rise regions in Philadelphia, Pa. The tests were designed to evaluate the methods for their applicability as location subsystems for Automatic Vehicle Monitoring systems. Two signpost concepts, one using semi-passive transponders and the other active transmitters, as well as two area-coverage concepts, one employing Loran-C and the other a pulse trilateration method, were tested. A summary of results and major findings are presented. GRA

N78-13963# Dynamic Science, Phoenix, Ariz.
CARGO TANKS, BOTTOM LOADING OF FLAMMABLE LIQUIDS. VOLUME 2. REVIEW AND ANALYSIS OF LIQUID LEVEL CONTROL SYSTEMS USED IN BOTTOM LOADING OF FLAMMABLE LIQUIDS INTO CARGO TANKS
N. B. Johnson, L. H. Tyndall, and R. L. Anderson Jun. 1977 79 p
(Contract DOT-FH-11-9091)
(PB-271430/1; Rept-3978-77-27; DOT-FH-11-9091-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 13F

Bottom loading systems of flammable liquids into cargo tanks were investigated with two overall objectives: (1) review the mechanical aspects of bottom loading of cargo tanks with regard to devices or procedures for removing liquid products from loading lines under tanks and protection of loading lines from underride accidents; (2) review liquid level sensing systems presently available, with special emphasis placed on safety characteristics, compatibility and adaptability of systems used as they differ from tank vehicle to loading terminal, failsafe features built into the systems, and longevity of these systems with a view to possible retest criteria. This volume summarizes the work performed on the second objective. This includes a review of available design, an analysis of the safety features of each design, a review of existing standards and recommended procedures, and recommended performance criteria. GRA

N78-13964# Oak Ridge National Lab., Tenn.
TECHNOLOGY ASSESSMENT OF MODULAR INTEGRATED UTILITY SYSTEMS. VOLUME 1: SUMMARY REPORT
W. R. Mixon, S. B. Ahmed, W. L. Griffith, K. E. Phillips, W. H. Boegly, Jr., V. O. Haynes, G. Samuels, W. H. Brown, J. O. Kolb, C. L. Segaser et al Dec. 1976 68 p refs
(Contract W-7405-eng-26; HUD IAA H-40-72;
ERDA-40-333-72)
(ORNL/HUD/MIUS-24-Vol-1) Avail: NTIS HC A04/MF A01

The technology under assessment is MIUS, which would use an onsite combined package plant, smaller than conventional plants, to provide communities of limited size with electricity, heating and air conditioning, water and waste treatment, and waste disposal. It employs an integrated systems approach whereby some resource requirements of one service are met by using the effluent of another. The consequences of the widespread utilization of MIUS to the year 2000 were identified and evaluated. A comparative analysis of MIUS vs. alternative conventional utility system impacts was conducted, which briefly describes the MIUS concept, the assessment task, MIUS and conventional utility system technologies, potential MIUS applications and market, and expected impacts by category. Impact categories include resources, economic, environmental, psychological/social, national goals and policies, institutional and demographic.

N78-13965# Battelle Pacific Northwest Labs., Richland, Wash.
SIMILARITY INDICES. 1: WHAT DO THEY MEASURE
J. W. Johnston Nov. 1976 36 p refs
(Contract EY-76-C-06-1830)
(BNWL-2152-Add-1) Avail: NTIS HC A03/MF A01

A method for estimating the effects of environmental effusions on ecosystems is described. The characteristics of 25 similarity indices used in studies of ecological communities were investigated. The type of data structure, to which these indices are frequently applied, was described as consisting of vectors of measurements on attributes (species) observed in a set of samples. A general similarity index was characterized as the result of a two-step process defined on a pair of vectors. In the first step an attribute similarity score is obtained for each attribute by comparing the attribute values observed in the pair of vectors. The result is a vector of attribute similarity scores. These are combined in the second step to arrive at the similarity index. Usually, second step was a simple sum or weighted sum of the attribute similarity scores. It is concluded that similarity indices should not be used as the test statistic to discriminate between two ecological communities. ERA

N78-13965# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Hamburg (West Germany). Inst. fuer Flugmedizin.
COMFORT CRITERIA FOR PASSENGERS OF RAPID TRANSIT SYSTEMS [BEITRAG ZUR FESTLEGUNG VON KOMFORTKRITERIEN FUER INSASSEN VON SCHNELLBAHNSYSTEMEN]
L. Vogt 1975 43 p refs In GERMAN and ENGLISH
(DLR-IB-355-75-08) Avail: NTIS HC A03/MF A01

The possibility of determining a common comfort limit for passengers traveling on rapid transit systems was investigated.

The impairment of comfort by mechanical vibrations is discussed for low frequencies and the supine, sitting, and standing position. The effects of linear acceleration on comfort are reviewed. ESA

N78-13967# Occidental Research Corp., La Verne, Calif.
PRYOLSIS OF INDUSTRIAL WASTES FOR OIL AND ACTIVATED CARBON RECOVERY Final Report, Aug. 1972 - Mar. 1975
F. B. Boucher, E. W. Knell, G. T. Preston, and G. M. Mallan May 1977 192 p
(Grant EPA-S-801202)
(PB-270961/6; EPA-600/2-77-091) Avail: NTIS HC A09/MF A01 CSCL 13B

A flash pyrolysis process was developed which can produce up to two barrels of synthetic fuel oil from a ton of dry cellulosic solids. The results are presented of a four-phase laboratory, pilot plant, product evaluation and engineering evaluation program to study the pyrolytic conversion of Douglas fir bark, rice hulls, grass straw and animal feedlot waste to synthetic fuel oil and char. A wax by-product was obtained from the pyrolysis of fir bark and grass straw. Excellent pilot plant material balances were obtained for oil production runs on Douglas fir bark and rice hulls, and these were satisfactorily combusted in a standard test boiler. Tree bark char was satisfactorily compressed to produce excellent quality charcoal briquettes. The economic evaluation shows that a 1200 dry ton/day tree bark conversion plant could be built and operated with a profit of about $10/ton of dry bark. GRA

N78-13968# Sealectro Corp., West Caldwell, N. J.
OZONE TREATMENT OF CYANIDE-BEARING PLATING WASTE Final Report
L. Joseph Bollyky Jun. 1977 53 p refs Prepared in cooperation with PCI Ozone Corp.
(Grant EPA-R-802335)
(PB-271015/0; EPA-600/2-77-104) Avail: NTIS HC A04/MF A01 CSCL 13B

The use of ozone for CN destruction in the metal finishing industry has long been recognized as a technically attractive alternative to chlorine oxidation. High capital cost has, in earlier years, prevented its implementation. A full scale installation is documented in which it was demonstrated that alkaline cyanide waste could be effectively destroyed to levels well below 1 ppm and with CN(-) removals of 99% at the levels normally encountered. Design features, problems and capital and operating cost data are presented and discussed. Selected aspects of the cyanide-ozone reaction were also studied, such as the effect of CN(-)/O3 ratios, cyanide source and concentration and the effectiveness of ozone for cyanate elimination. GRA

N78-13969# Southern Research Inst., Birmingham, Ala.
ELECTRO-REGENERATED ION-EXCHANGE DEIONIZATION OF DRINKING WATER Final Report
Thomas A. Davis Jun. 1977 83 p refs
(Contract EPA-68-03-2209)
(PB-270910/3; SORI-EAS-77-069; EPA-600/1-77-035) Avail: NTIS HC A05/MF A01 CSCL 13B

The development is outlined of a device for removal of inorganic salts from drinking water to facilitate the subsequent concentration of organic solutes for bioassay. Prior attempts to concentrate the organic solutes by reverse osmosis (RO) resulted in precipitation of the inorganic salts. To prevent this precipitation, the drinking water is pretreated by Electro-Regenerated Ion-exchange Deionization (ERID). The ERID device developed for this purpose is essentially an electrodialyzer with thick depleting compartments packed with a mixture of anion- and cation-exchange resin beads. The resins provide a conductive medium for electrical transport of ions out of the demineralized water, through ion-exchange membranes, and into a concentrated waste stream. GRA

N78-13970# Pennsylvania Univ., Philadelphia. Transportation Studies Center.
A STUDY OF EFFICIENCY INDICATORS OF URBAN PUBLIC TRANSPORTATION SYSTEMS Final Report
Anthony R. Tomazinis Jan. 1977 324 p refs
(Contract DOT-OST-50228)
(PB-270940/0; DOT-TST-77-47) Avail: NTIS HC A14/MF A01 CSCL 13B

A research project was undertaken on efficiency problems of urban public transportation systems (UPTS). The UPTS are first divided into three major system components, i.e. primary services, support functions, and the network. Then each system is divided by mode, and each component by each distinct function carried within the system component. The inputs to the system are also divided by type, i.e. labor, capital, and energy, and according to the contributor, i.e. the operator, the direct user, the society at large, and the government at all levels. Input units are also traced in terms of money costs and physical units. Efficiency analysis is then explored in a hierarchical manner exploring three types of relationships, i.e. system inputs vs. system outputs; component inputs vs. component inputs; and component outputs vs. component outputs. Efficiency indicators are then discussed as to the type of useful service they may offer in various types of efficiency analysis problems. GRA

N78-13971# Brown and Caldwell, Walnut Creek, Calif.
DESIGN PROCEDURES FOR DISSOLVED OXYGEN CONTROL OF ACTIVATED SLUDGE PROCESSES Final Report, Jun. 1974 - Oct. 1976
Michael J. Flanagan and Brian D. Bracken Jun. 1977 236 p refs
(Contract EPA-68-03-2130)
(PB-270960/8; EPA-600/2-77-032) Avail: NTIS HC A11/MF A01 CSCL 13B

Design procedures and guidelines for the selection of aeration equipment and dissolved (DO) control systems for activated sludge treatment plants are presented. Aeration methods, equipment and application techniques are examined and selection procedures offered. Various DO control systems are described with recommendations for system applications to various aeration equipment types and process configurations. Performance, operational, and maintenance data for aeration equipment and DO control systems for twelve activated sludge plants is presented. GRA

N78-13972# State Univ. of New York, Syracuse. School of Biology, Chemistry and Ecology.
UTILIZATION OF SOIL INVERTEBRATES IN STABILIZATION, DECONTAMINATION AND DETOXIFICATION OF RESIDUAL SLUDGES FROM TREATMENT OF WASTEWATER Interim Report
Roy Hartenstein and Myron J. Mitchell Jun. 1977 138 p refs
(Grant NSF ENV-76-17225)
(PB-271141/4; NSF/RA-770138) Avail: NTIS HC A07/MF A01 CSCL 13B

The problem of reducing the organic matter content in sludge without destroying the biological value of sludge is addressed. It is proposed that earthworms can be used effectively in a managerial sense to convert a relatively infertile sludge into a fertile, organic topsoil. Together with nematodes, bacteria, and other microorganisms, they can effect deodorization, destruction of Salmonella, and reduction of the unstable organic content of sludges. Research objectives focused on the following: (1) sludge toxicity to earthworms; (2) degradation and stabilization of sludge; (3) modification of certain chemical properties of sludge; (4) effect of soil macroin-vertebrates on bacterial and nematode populations; and (5) effect of earthworms on salmonella typhimurium. ERA

N78-13973# Department of Transportation, Washington, D. C. Office of the Assistant Secretary for Systems Development and Technology.
THE URBAN CONSORTIUM AND ITS TRANSPORTATION TASK FORCE: A FEDERAL PERSPECTIVE Progress Report, Jan. 1975 - Jul. 1977
Alfonso B. Linhares Jul. 1977 24 p
(PB-271282/6; DOT-TST-77-45) Avail: NTIS HC A02/MF A01 CSCL 13B

An overview is given of the U.S. Department of Transportation's cooperative interactions with the Transportation Task Force of the Urban Consortium for Technology Initiatives. The Consortium is a coalition of 34 major urban governments which is developing an agenda of research, development, and demonstration needs and data packages in priority need areas. The report describes the logic which led to the formation of the Consortium, the

various management mechanisms which evolved, the procurement and administrative approaches used, and the types of outputs which are being produced. GRA

N78-13974# General Accounting Office, Washington, D. C. Community and Economic Development Div.
UNNECESSARY AND HARMFUL LEVELS OF DOMESTIC SEWAGE CHLORINATION SHOULD BE STOPPED. ENVIRONMENTAL PROTECTION AGENCY
30 Aug. 1977 58 p refs
(PB-271288/3; CED-77-108) Avail: NTIS HC A04/MF A01 CSCL 13B

The use of chlorine to disinfect domestic sewage at municipal waste treatment plants is discussed. Chlorine is frequently used to disinfect domestic sewage. It is also used in industry and is discharged in various industrial wastes. Chlorinated discharges are shown to be harmful to the aquatic environment, but such discharges are still largely uncontrolled. Unnecessary chlorination and whether, when disinfection is needed, municipalities and industries have prevented harmful levels of chlorine from being discharged into waterways is examined. GRA

N78-13975# Municipality of Metropolitan Seattle, Wash.
MAGIC CARPET EVALUATION STUDY Final Report
May 1977 110 p Sponsored by UMTA
(PB-271214/9; UMTA-WA-09-0012-77-1) Avail: NTIS HC A06/MF A01 CSCL 13B

The fare-free zone, Magic Carpet, evaluation project is described. It consists of a series of surveys aimed at measuring the effectiveness of downtown free buses in achieving improvement of downtown air quality, reduction of traffic congestion, conservation of gasoline, and stimulation of retail trade. Surveys indicate that faro-free bus service is responsible for attracting at least $5,000,000 in retail sales. The findings have encouraged the Seattle and Metro Councils to continue this service for at least two more years, at a cost to the city of $100,000 per year. GRA

N78-13976# Trans Systems Corp., Vienna, Va.
ASSESSMENT OF BATTERY BUSES Final Report, Mar. - Jul. 1977
Jul. 1977 156 p refs
(Contract DOT-UT-70056)
(PB-271321/2; TS-102; UMTA-VA-06-0044-77-1) Avail: NTIS HC A08/MF A01 CSCL 13F

A comprehensive assessment is given of the performance of electric battery buses operating in passenger-carrying services in the United States, Europe, Japan, and Australia. The survey assessed 16 different systems from 15 suppliers, operating under 18 public transit authorities. These operations varied from single demonstration vehicles to a fleet of 20 buses which provide all the transit service on three routes. The scope of this report includes description of buses and propulsion systems, analysis of data and conclusions about the problems and constraints in the procurement and operation of electric buses. The study also addresses hybrid propulsion systems such as trolley-battery and diesel-battery hybrids. GRA

88 SPACE SCIENCES (GENERAL)

N78-13977*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
REVIEW OF THE ABSORPTION SPECTRA OF SOLID O2 AND N2 AS THEY RELATE TO CONTAMINATION OF A COOLED INFRARED TELESCOPE
Sheldon M. Smith Sep. 1977 18 p refs
(NASA-TM-78442; A-7226) Avail: NTIS HC A02/MF A01 CSCL 03B

During contamination studies for the liquid helium cooled shuttle infrared telescope facility, a literature search was conducted to determine the absorption spectra of the solid state of homonuclear molecules of O2 and N2, and ascertain what laboratory measurements of the solid have been made in the infrared. With the inclusion of one unpublished spectrum, the absorption spectrum of the solid oxygen molecule has been thoroughly studied from visible to millimeter wavelengths. Only two lines appear in the solid that do not also appear in the gas or liquid. A similar result is implied for the solid nitrogen molecule because it also is homonuclear. The observed infrared absorption lines result from lattice modes of the alpha phase of the solid, and disappear at the warmer temperatures of the beta, gamma, and liquid phases. They are not observed from polycrystalline forms of O2, while strong scattering is. Scattering, rather than absorption, is considered to be the principal natural contamination problem for cooled infrared telescopes in low earth orbit. Author

N78-13978# Centre National d'Etudes Spatiales, Paris (France).
FRENCH SPACE PROGRAM
1977 138 p refs In FRENCH Presented at the 20th COSPAR Plenary Meeting and Assoc. Activities, Tel Aviv, 7-18 Jun. 1977
Avail: NTIS HC A07/MF A01

The report to COSPAR on the French space programs is presented. The organization and basic activities of CNES are mentioned. Separate sections deal with astronomy outside the solar system, solar physics and solar system, physics of the ionosphere and magnetosphere, aeronomy, meteorology, oceanology, remote sensing geodesy and aerodynamics, space biology and medicine, and materials sciences. ESA

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N78-13979# McElroy (Ralph) Co., Austin, Tex.
IMAGING X-RAY STARS WITH A HOLOGRAM TELESCOPE
H. J. Einighammer Feb. 1977 22 p
(UCRL-Trans-11220) Avail: NTIS HC A02/MF A01

The theoretical resolving limit of the Mertz and Young process for imaging cosmic X-ray sources by means of the Fresnel transformation is experimentally verified. There are difficulties in the reconstruction of the star images from the shadow hologram when numerous zone patterns are superimposed. The loss of information could be minimized in this case by using zone plates having zones of reduced width. The advantage of the process in comparison with a pinhole camera of equal resolution is a significantly less exposure time. In this experiment a factor of 30 was yielded. This is demonstrated with the use of microdensiome tracings. The holograms were prepared by photographic superposition. ERA

N78-13980# Mons Univ. (Belgium). Dept. d'Astrophysique.
ULTRAVIOLET OBSERVATIONS OF BETA-CEPHEI AND BETA-CANIS MAJORIS
Francoise Beeckmans (Liege Univ.), Marijke Burger, Cornelis deJager (Astron. Inst., Utrecht), and Theo M. Kamperman (Astron. Inst., Utrecht) 1975 9 p refs Presented at the Multiple Periodic Variable Stars IAU Colloq. No. 29, Budapest, 1975
(Commun-61) Avail: NTIS HC A02/MF A01

Results of ultraviolet observations obtained from onboard ESRO TD-1A satellite experiments S2/68 and S59 are presented. The Utrecht stellar spectrophotometer S59 recorded stellar fluxes in the spectral ranges 2060 to 2160, 2495 to 2595, and 2770 to 2870 A with a spectral resolution of about 1.8 A. The experiment S2/68, a combined experiment of British and Belgian groups, observed in the regions 1350 to 1750, 1750 to 2150, and 2150 to 2550 A with a resolution of 36 A. The variations of beta-Cep and beta-CMa observed are presented graphically. If a radiation temperature between 20,000 and 25,000 K is assumed, the temperature difference between minimum and maximum will be 600 to 1000 K for beta-Cep and 200 to 400 K for beta-CMa. ESA

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N78-13981*# National Aeronautics and Space Administration, Washington, D. C.
EXPLODING STARS, PULSARS AND BLACK HOLES IN SPACE
Nicholas Panagakos Nov. 1977 6 p
(NASA-News-Release-77-243; P77-10242) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 03B

Brief factual reviews are provided for supernovae, pulsars and neutron stars, and black holes. Also discussed in general terms are red giants, white dwarfs, quasars and radio galaxies. B.L.P.

N78-13982*# Hawaii Univ., Honolulu. Inst. for Astronomy.
STABILITY OF WATER ON THE GALILEAN SATELLITES
Carl B. Pilcher 1976 6 p Presented at Colloq. on Water in Planetary Regoliths, Hanover, N. H., 5-7 Oct. 1976; sponsored jointly by NASA, Army Cold Regions Res. and Eng. Lab., Am. Geophys. Union and NAS-NRC
(NASA-CR-155330) Avail: NTIS HC A02/MF A01 CSCL 03B

The selective loss of water from Io under currently prevailing physical conditions was studied to determine whether a large quantity of water can be lost from the satellite over the lifetime of the solar system. Loss processes considered include: thermal escape, photolysis, sputtering, and gas-phase charged particle interactions. Author

N78-13983# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
FORBIDDEN LINE CALCULATIONS OF ASTROPHYSICAL INTEREST
H. R. Rugge and L. A. Christopher 15 Nov. 1977 415 p refs
(ATR-78(8219)-1) Avail: NTIS HC A18/MF A01

A recent compilation of atomic parameters was used to calculate the emissivities of a number of fine structure infrared forbidden lines of astrophysical interest. Emissivities and level population densities of ions from isoelectronic configurations 2p sup 1; 2p sup 5, 3p sup 1, and 3p sup 5 (two level ions) were calculated at four temperatures (T=5000 K, 10,000 K, 10,5000 K and 20,000 K) for eighteen ions. Emissivities, level population densities, and relative intensities of both infrared and visible forbidden lines from isoelectronic configurations 2p sup 2, 2p sup 4, 3p sup 2, and 3p sup 4 (five level ions) were also calculated, at the same temperatures, for fifteen ions. Author

N78-13984*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SURVEY OF INTERSTELLAR HI FROM L ALPHA ABSORPTION MEASUREMENTS 2
R. C. Bohlin (Lockheed Missiles and Space Co., Palo Alto, Calif.), B. D. Savage (Wisconsin Univ., Madison), and J. F. Drake Oct. 1977 32 p refs Submitted for publication
(NASA-TM-78044; X-681-77-255) Avail: NTIS HC A03/MF A01 CSCL 03B

The Copernicus satellite surveyed the spectral region near L alpha to obtain column densities of interstellar HI toward 100 stars. The distance to 10 stars exceeds 2 kpc and 34 stars lie beyond 1 kpc. Stars with color excess E(B-V) up to 0.5 mag are observed. The value of the mean ratio of total neutral hydrogen to color excess was found to equal 5.8 x 10 to the 21st power atoms per (sq cm x mag). For stars with accurate E(B-V), the deviations from this mean are generally less than a factor of 1.5. A notable exception is the dark cloud star, rho Oph. A reduction in visual reddening efficiency for the grains that are larger than normal in the rho Oph dark cloud probably explains this result. The conversion of atomic hydrogen into molecular form in dense clouds was observed in the gas to E(B-V) correlation plots. The best estimate for the mean total gas density for clouds and the intercloud medium, as a whole, in the solar neighborhood and in the plane of the galaxy is 1.15 atoms per cu. cm; those for the atomic gas and molecular gas alone are 0.86 atoms per cu cm and 0.143 molecules per cu cm respectively. For the intercloud medium, where molecular hydrogen is a negligible fraction of the total gas, atomic gas density was found to equal 0.16 atoms per cu cm with a Gaussian scale height perpendicular to the plane of about 350 pc, as derived from high latitude stars. Author

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N78-13985*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
RADIOACTIVITIES IN RETURNED LUNAR MATERIALS Semiannual Progress Report, 1 Aug. 1976 - 31 Jul. 1977
Edward L. Fireman Nov. 1977 8 p refs
(Grant NGR-09-015-145)
(NASA-CR-155337; SAPR-12; SAPR-13) Avail: NTIS HC A02/MF A01 CSCL 03B

Results from a carbon-14 study in size fractions of lunar soil are reported. The 10 to 30 micrometers and 74 to 124 micrometers size fraction results were supplemented by 30 to 37 micrometers results that are given in this report. The gases from the less than 10 micrometers fraction were extracted and purified and carbon-14 counting is now in progress. Meteorites were also studied using carbon-14, with emphasis directed to those recently discovered in the Antarctic. Author

N78-13986*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DUST STORMS ON MARS: CONSIDERATIONS AND SIMULATIONS
Ronald Greeley, Bruce R. White (Calif. Univ., Davis), James B. Pollack, James D. Iverson (Iowa State Univ., Ames), and Rodman N. Leach Dec. 1977 32 p refs Presented at the Desert Dust Symp., Denver, 1977; sponsored by the Am. Assoc. for the Advan. of Sci. Submitted for publication
(NASA-TM-78423; A-7152) Avail: NTIS HC A03/MF A01 CSCL 03B

Aeolian processes are important in modifying the surface of Mars at present, and appear to have been significant in the geological past. Aeolian activity includes local and global dust storms, the formation of erosional features such as yardangs and depositional features such as sand dunes, and the erosion of rock and soil. As a means of understanding aeolian processes on Mars, an investigation is in progress that includes laboratory simulations, field studies of earth analogs, and interpretation of spacecraft data. This report describes the Martian Surface Wind Tunnel, an experimental facility established at NASA-Ames Research Center, and presents some results of the general investigation. Experiments dealing with wind speeds and other conditions required for the initiation of particle movement on Mars are described and considerations are given to the resulting effectiveness of aeolian erosion. Author

N78-13987*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MERCURY'S HELIUM EXOSPHERE AFTER MARINER 10'S THIRD ENCOUNTER
S. A. Curtis and R. E. Hartle Nov. 1977 30 p refs Submitted for publication
(NASA-TM-78056; X-621-77-269) Avail: NTIS HC A03/MF A01 CSCL 03B

From Mariner 10 third encounter UV data, a value of .00045 was calculated as the fraction of the solar wind He++ flux intercepted and captured by Mercury's magnetosphere if the observed He atmosphere is maintained by the solar wind. If an internal source for He prevails, the corresponding upper bound for the global outgassing rate is estimated to be 4.5 x 10 to

the 22nd power per sec. A surface temperature distribution was used which satisfies the heat equation over Mercury's entire surface using Mariner 10 determined mean surface thermal characteristics. The means stand off distance of Mercury's magnetopause averaged over Mercury's orbit was also used.
Author

N78-13988# Argonne National Lab., Ill.
TRACE ELEMENT GEOCHEMISTRY AND THE EARLY LUNAR DIFFERENTIATION
Stanka Jovanovic and George W. Reed, Jr. 1977 21 p refs Presented at Lunar Sci. Conf., Houston, Tex., 14-18 Mar. 1977
(Contract W-31-109-eng-38)
(CONF-770322-1) Avail: NTIS HC A02/MF A01

Convection cells in the early lunar magma ocean suggest a laterally inhomogeneous crust. In general, mineralogy and petrology of samples may be relatively insensitive to which cell they evolved in since major and minor element concentrations would not be expected to vary greatly from cell to cell. It is established that, although most samples are local material, a few samples are fragments of projectiles that excavated secondary craters and that they are exotic to their present locations. Caution must be exercised in genetically relating samples found at a given site. Ru and Os have been fractionated from one another and also partitioned in the stratigraphic column resulting from the differentiation of the early lunar magma ocean. Lithic breccias contain two types of fractionated Ru-Os which appear to be related to near surface crustal stratigraphy. Basalts contain fractionated Ru-Os which is correlated with their depth of origin. ERA

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N78-13989# Comstock and Wescott, Inc., Cambridge, Mass.
MODIFICATION OF A SOLAR EUV SPECTROMETER Final Report, 1 Nov. 1975 - 30 Jun. 1977
John F. McGrath and Joseph P. Padur 31 Jul. 1977 24 p
(Contract F19628-76-C-0041)
(AD-A045018; AFGL-TR-77-0145) Avail: NTIS HC A02/MF A01 CSCL 14/2

This report describes the modification of a solar extreme ultraviolet double spectrometer (RM-60) for sounding rockets. This instrument is of the grazing-incidence grating spectrometer design. This report also covers the modification of the existing ground support equipment (GSE) as well as the auxiliary experiment. Author (GRA)

N78-13990# Brandeis Univ., Waltham, Mass. Dept. of Physics.
SOLAR ATMOSPHERIC DYNAMICS Final Report, 19 Sep. 1974 - 30 Sep. 1976
R. F. Stein May 1977 22 p
(Contract F19628-75-C-0013)
(AD-A045017; AFGL-TR-77-0108) Avail: NTIS HC A02/MF A01 CSCL 03/2

This study seeks to calculate the generation and propagation of Magneto-Acoustic Gravity (M.A.G.) waves in the solar atmosphere and their effect on the heating of the chromosphere and corona. A computer program has been written, which is capable of integrating the equations of motion of such waves, which are inherently three-dimensional. To simplify the equations, without seriously distorting the nature of the motions, we impose a fixed horizontal modal structure consisting of 6 waves propagating horizontally in a hexagonal pattern. These equations need to be integrated in time and only one spatial direction - the vertical. The program is currently being tested for the simpler case of non-vertically propagating acoustic-gravity waves. We have also analyzed Skylab UV data for evidence of acoustic pulses in the transition region and calculated the steady state structure of the solar wind flow along a magnetic flux tube that diverges more rapidly than vertically. Author (GRA)

N78-13991# Johns Hopkins Univ., Laurel, Md. Applied Physics Lab.
INTER-RELATIONSHIPS OF SOLAR AND INTERPLANETARY PLASMA, MAGNETIC FIELDS AND ENERGETIC PARTICLES RELEVANT TO THE PREDICTION OF SOLAR-TERRESTRIAL DISTURBANCES
E. C. Roelof 29 Jul. 1977 157 p refs
(Contract N00017-72-C-4401)
(AD-A045021; Scientific-2; AFGL-TR-77-0166) Avail: NTIS HC A08/MF A01 CSCL 03/2

A summary is presented of research from the past year's efforts supported under this contract. The research covered inter-related topics in solar-terrestrial relationships. It is recommended that the present dual approach of investigations of solar-terrestrial events both of the past solar cycle as well as contemporary observations be continued. Comparison of phenomena among different phases of the solar cycle have identified several inter-relationships useful in the development of prediction techniques for geomagnetic disturbances and solar energetic particle events. Author (GRA)

N78-13992# National Oceanic and Atmospheric Administration, Boulder, Colo.
SOLAR X-RAY MEASUREMENTS FROM SMS-1, SMS-2, AND GOES-1, INFORMATION FOR DATA USERS
R. F. Donnelly, R. N. Grubb, and F. C. Cowley Jun. 1977 65 p refs
(PB-271676/9; NOAA-TM-ERL-SEL-48; NOAA-77081101) Avail: NTIS HC A04/MF A01 CSCL 03B

Solar broadband X-ray measurements in the 1/2-4 A and 1-8 A ranges from the SMS and GOES satellites are described, including the following: time coverage, detector transfer functions, solar spectra sensitivity, in-flight calibrations, and intercomparisons of concurrent measurements from the SMS-1, SMS-2, and GOES-1 satellites. GRA

N78-13993# Air Force Geophysics Lab., Hanscom AFB, Mass.
OVERVIEW OF SOLAR-TERRESTRIAL PHYSICS PHENOMENA FOR THE RETROSPECTIVE WORLD INTERVAL OF 20 MARCH - 5 MAY 1976 Interim Report
M. A. Shea 28 Sep. 1977 11 p refs Repr. from Collected data reports for STIP Interval II, report no. WAG-61, Aug. 1977
(AF Proj. 2311)
(AD-A045405; AFGL-TR-77-0211) Avail: NTIS HC A02/MF A01 CSCL 03/2

A summary of the significant solar-terrestrial events that occurred during the Retrospective World Interval of 20 March - 5 May 1976 has been prepared using data available at the present time. Although this period occurred at solar minimum, it was an active interval - one in which the principal events were associated with solar activity in a region at Carrington Longitude approximately 45. (This active center was designated McMath Plage 14143 during solar rotation 1639 and renumbered McMath Plage 14179 during solar rotation 1640). Among the events summarized are the following: (1) solar activity during the period 20-23 March 1976 from a region behind the eastern limb of the sun; (2) a large geomagnetic storm with intense mid-latitude auroral activity on 26 March; (3) moderate solar particle intensities at the earth from 26 through 31 March; and (4) a ground-level solar cosmic ray event on 30 April having a very hard spectrum. Author (GRA)

N78-13994# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 395, JULY 1977, PART 2. COMPREHENSIVE REPORTS. DATA FOR JANUARY 1977 - DECEMBER 1976 AND MISCELLANEA
Helen E. Coffey Jul. 1977 42 p
(PB-272164/5; SGD-395-Pt-2; NOAA-77082509-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 03B

A comprehensive report is provided for January 1977, December 1976 and miscellaneous data containing information on: active regions, synoptic solar maps, solar flares, solar radio waves, energetic solar particles and plasma, synoptic chart, abbreviated calendar record, regional flare index, and daily solar activity centers. GRA

N78-13995# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 395, JULY 1977, PART 1 Progress Report, May - Jun. 1977
Helen E. Coffey Jul. 1977 127 p
(PB-272163/7; SGD-395-Pt-1; NOAA-77082508-Pt-1) Avail: NTIS HC A07/MF A01 CSCL 03B

Data for June 1977 is provided regarding: alert periods, daily solar indices, solar flares, solar radio waves, solar X-ray radiation, coronal holes, spacecraft observations, mean solar magnetic field, and solar wind measurements. Data is also presented for May 1977 on: daily solar activity centers, sudden ionospheric disturbances, solar radio waves, cosmic rays, geomagnetic indices and radio propagation indices. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N78-13996 Washington Univ., Seattle.
NUCLEAR INTERACTIONS OF VERY HIGH ENERGY COSMIC RAYS Ph.D. Thesis
James William Martin 1977 146 p
Avail: Univ. Microfilms Order No. 77-18382

An energy estimate, E prime(ch), which has greater precision than E(ch) is presented: Emulsion spectrographs were designed, built, and exposed to the primary cosmic radiation in high altitude balloon flights. Six interactions of very high energy primary nucleons and nuclei were measured. The primary energy was estimated by the electromagnetic shower intensity and by the E prime(ch) estimate. An estimate of the multiplicity of nucleon collisions in plastic at 10 TeV, and angular distributions in the variable log tan theta are presented. Dissert. Abstr.

N78-13997*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A DISTANCE LIMIT FOR A CLASS OF MODEL GAMMA-RAY BURST SOURCES
Wolfgang K. H. Schmidt Jun. 1977 13 p refs Submitted for publication
(NASA-TM-78053; X-661-77-152) Avail: NTIS HC A02/MF A01 CSCL 03B

Gamma ray burst sources are presumably not larger than 10 to the 9th power cm as inferred from observed flux variations. If they are homogeneous and isotropically radiating, then from photon density considerations, they would have to be optically thick due to gamma-gamma pair production when assumed to be too far away. Deviations of observed photo spectra from an exponential shape around 1 MeV lead to an upper limit of the possible distance of such sources of only 2 kpc from the sun. Thus the sources must be galactic unless the radiation is highly beamed or emerges from a relativistically moving shell. This conclusion depends only on observed parameters. The possible presence of particles and fields in the sources would require them to be even closer. Author

99 GENERAL

No abstracts in this category.

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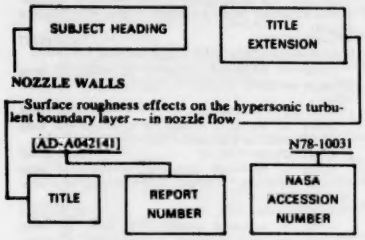

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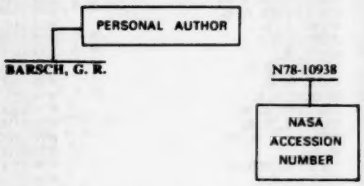

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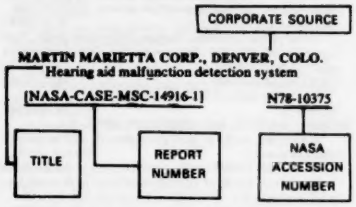

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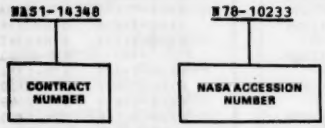

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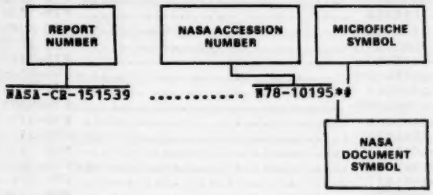

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AFPEA-77-P7-31 ..... N78-13127 #

AFRPL-TR-77-48-VOL-2 ..... N78-13126 #
AFRPL-TR-77-52 ..... N78-13125 #

AFRRI-TM77-1 ..... N78-13291 #
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AFWL-TR-76-230 ..... N78-13335 #

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AIAA-PAPER-77-521 ..... N78-13536*#

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AMMRC-CTR-76-32-VOL-1 ..... N78-13067 #
AMMRC-CTR-77-22 ..... N78-13481 #

AMMRC-MS-77-5 ..... N78-13482 #

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AWL-K-77-3542-1 ..... N78-13594 #
AWL-K-77-3558-1 ..... N78-13607 #

AWL-76-XX-37 ..... N78-13681 #
AWL-77-XX-70 ..... N78-13646 #
AWL-77-18 ..... N78-13587 #
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APL/JHU/QM-76-120 ..... N78-13275 #
APL/JHU/SEV-005 ..... N78-13275 #
APL/JHU/TG-1307 ..... N78-13382 #
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ARC-CP-1376 ..... N78-13023 #
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ARO-PWT-TR-77-36 ..... N78-13080 #
ARO-PWT-TR-77-43 ..... N78-13388 #

ARO-9653.93-M ..... N78-13809 #
ARO-11431.3-C ..... N78-13189 #
ARO-11782.13-MS ..... N78-13210 #
ARO-12162.4-P ..... N78-13424 #
ARO-12224.12-P ..... N78-13867 #
ARO-12589.2-GS ..... N78-13680 #
ARO-12915.3-C ..... N78-13236 #
ARO-13058.3-EL ..... N78-13304 #
ARO-13168.10-MS ..... N78-13213 #
ARO-13896.1-C ..... N78-13168 #
ARO-14315.5-C ..... N78-13189 #
ARO-14533.1-A-EL ..... N78-13778 #
ARO-15274.1-P ..... N78-13424 #

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ASI-TR-76-28 ..... N78-13007*#

ATR-78(8219)-1 ..... N78-13983 #

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BDX-613-1496-REV ..... N78-13214 #
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BF-R-63.052-1 ..... N78-13093 #

BLL-M-24903-(5828.4F) N78-13875
BLL-M-24911-(5828.4F) N78-13668
BLL-M-24914-(5828.4F) N78-13697
BLL-M-24921-(5828.4F) N78-13696
BLL-M-24927-(5828.4F) N78-13402
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BMI-X-679 ..... N78-13580 #

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BNL-NUREG-50610 ..... N78-13191 #

BNL-21920 ..... N78-13573 #
BNL-22282 ..... N78-13944 #
BNL-22512 ..... N78-13486 #
BNL-22524 ..... N78-13215 #
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BNWL-SA-6029 ..... N78-13574 #

BNWL-TR-244 ..... N78-13459 #

BNWL-2134 ..... N78-13571 #
BNWL-2152-ADD-1 ..... N78-13965 #
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BNWL-2235 ..... N78-13951 #

BRL-MR-2787 ..... N78-13389 #

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CALSPAN-CK-5976-M-1 ..... N78-13704 #

CAM-100-28 ..... N78-13293 #

CCA-77-10 ..... N78-13756 #

CED-77-108 ..... N78-13974 #
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CEEDO-TR-76-23 ..... N78-13640 #

CEL-CR-77-020 ..... N78-13450 #

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COM-74-503117 ..... N78-13864 #

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CONF-760203-10 ..... N78-13195 #
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CONF-761081-1 ..... N78-13891 #
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CONF-770210-3 ..... N78-13644 #
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CONF-770224-1 ..... N78-13732 #
CONF-770303-10 ..... N78-13199 #
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COO-2565-4 ..... N78-13591 #
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COO-2697-76/2 ..... N78-13605 #
COO-2713-3 ..... N78-13217 #
COO-2733-7 ..... N78-13484 #
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COO-3056-23 ..... N78-13599*#
COO-3084-49 ..... N78-13926 #
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CRREL-77-15 ..... N78-13515 #
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CWJ1/C-640003-VOL-2 ..... N78-13309 #
CWJ1/C-640003-VOL-3 ..... N78-13310 #
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C75-537/501 ..... N78-13420*#
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DLR-IB-355-76-01 ..... N78-13741 #
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DOT-HS-802-530 ..... N78-13466 #
DOT-HS-802-531 ..... N78-13467 #
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DOT-TSC-OST-77-33 ..... N78-13656 #

DOT-TSC-UMTA-77-28 ..... N78-13962 #

DOT-TST-77-45 ..... N78-13973 #
DOT-TST-77-47 ..... N78-13970 #

DRDMI-TD-CR-77-2 ..... N78-13768 #
DRDMI-TD-CR-77-4 ..... N78-13767 #

DRDMI-TE-77-16 ..... N78-13428 #

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DTNSRDC-ASED-384 ..... N78-13048 #
DTNSRDC-ASED-385 ..... N78-13021 #

D6-42877 ..... N78-13027*#
D180-19334-2 ..... N78-13105*#
D180-20689-1-PT-1-VOL-1 ..... N78-13099*#
D180-20689-2-PT-1-VOL-2 ..... N78-13100*#
D180-20689-3-PT-1-VOL-3 ..... N78-13101*#
D180-20689-4-PT-1-VOL-4 ..... N78-13102*#
D180-20689-5-PT-1-VOL-5 ..... N78-13103*#
D210-11094-2 ..... N78-13045 #
D210-11231-1 ..... N78-13038*#
D210-11231-2 ..... N78-13039*#

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E-8909 ..... N78-13124*#
E-9056-1 ..... N78-13181*#
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E-9085-2 ..... N78-13137*#
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E-9435 ..... N78-13182*#
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ECAC-PR-75-071-VOL-2 ..... N78-13284 #

ECOM-75-1324-F ..... N78-13562 #
ECOM-76-1301-4 ..... N78-13345 #
ECOM-4511 ..... N78-13337 #
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EPA-450/3-77-006 ..... N78-13639 #
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EPA-600/1-77-035 ..... N78-13969 #
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EPA-600/2-77-091 ..... N78-13967 #
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EPA-600/2-77-104 ..... N78-13968 #
EPA-600/2-77-110 ..... N78-13630 #
EPA-600/2-77-113 ..... N78-13178 #
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EPA-600/4-77-022 ..... N78-13651 #
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EPA-600/4-77-032 ..... N78-13163 #
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EPA-600/5-77-008A-VOL-1 ..... N78-13959 #
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EPA-600/7-77-072A-VOL-1 ..... N78-13616 #
EPA-600/7-77-072B-VOL-2 ..... N78-13617 #
EPA-600/7-77-072C-VOL-3 ..... N78-13618 #
EPA-600/7-77-072D-VOL-4 ..... N78-13619 #
EPA-901/9-76-004 ..... N78-13637 #
EPA-904/9-77-021 ..... N78-13658 #
EPA-906/9-77-003 ..... N78-13636 #
EPA-906/9-77-005 ..... N78-13635 #
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EPRI-EA-411-VOL-2 ..... N78-13590 #
EPRI-EA-418 ..... N78-13645 #
EPRI-EA-433-VOL-2 ..... N78-13575 #

EPRI-EM-319-VOL-1 ..... N78-13567 #
EPRI-EM-319-VOL-2-APP-A ..... N78-13566 #
EPRI-EM-319-VOL-3-APP-B ..... N78-13565 #
EPRI-EM-319-VOL-3-APP-C ..... N78-13565 #
EPRI-EM-319-VOL-3-APP-D ..... N78-13565 #
EPRI-EM-413(6-77) ..... N78-13595 #

EPRI-ER-289-SY-VOL-4 ..... N78-13900 #
EPRI-ER-439-SR ..... N78-13239 #

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EPRI-217-1 ..... N78-13488 #
EPRI-255-TR-1 ..... N78-13598 #
EPRI-255-TR-2 ..... N78-13597 #
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ERDA-31-109-38-2962 ..... N78-13598 #
ERDA-31-109-38-2962-TR-2 ..... N78-13597 #
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ERDA-77-52 ..... N78-13892 #

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ERDA/NASA-1022/76/5 ..... N78-13608*#

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ER77-4128-VOL-2 ..... N78-13306 #

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ESA-CR(P)-972-VOL-1 ..... N78-13308 #
ESA-CR(P)-972-VOL-2 ..... N78-13309 #
ESA-CR(P)-972-VOL-3 ..... N78-13310 #
ESA-CR(P)-972-VOL-4 ..... N78-13311 #
ESA-CR(P)-972-VOL-5-SUBM ..... N78-13312 #
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ESA-CR(P)-977-VOL-1 ..... N78-13519 #

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ESA-CR(P)-993 ..... N78-13463 #
ESA-CR(P)-994-VOL-1 ..... N78-13759 #
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ESA-CR(P)-994-VOL-3 ..... N78-13761 #
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ESA-CR(P)-996-VOL-1 ..... N78-13095 #
ESA-CR(P)-996-VOL-2 ..... N78-1309[illegible] #
ESA-CR(P)-996-VOL-3 ..... N78-13097 #
ESA-CR(P)-997 ..... N78-13398 #
ESA-CR(P)-998-VOL-1 ..... N78-13128 #
ESA-CR(P)-998-VOL-2 ..... N78-13129 #

ESA-ESTL-27 ..... N78-13463 #

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ESA-SP-1004 ..... N78-13083 #

ESA-TT-400 ..... N78-13464 #
ESA-TT-410 ..... N78-13114 #
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ESD-TR-77-140 ..... N78-13753 #
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ETI-TR77-49 ..... N78-13919 #

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FAA-RD-75-110-2 ..... N78-13078 #
FAA-RD-77-6 ..... N78-13079 #
FAA-RD-77-56-VOL-2 ..... N78-13284 #
FAA-RD-77-56-1 ..... N78-13288 #

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FEA/N-76/414-VOL-4 ..... N78-13559 #

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FHWA/KS/RD-76-2 ..... N78-13273 #
FHWA/LA-77/73-1 ..... N78-13278 #

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FTD-ID(RS)I-0759-77 ..... N78-13452 #
FTD-ID(RS)T-0606-77 ..... N78-13187 #
FTD-ID(RS)T-0763-77 ..... N78-13072 #

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